

**MANPOWER** Studies No. 4

**COMPUTERS IN OFFICES**



*LONDON*

HER MAJESTY'S STATIONERY OFFICE

1965

This Report by the Manpower Research Unit discusses the effect of computers on office employment. It is the fourth in a series of reports by the Unit designed to assist in the consideration of manpower policy as well as of economic planning more generally. The information on which the Report is based and the methods used in assessing this material are described where appropriate in the text and in Appendices 17 to 19.

Previous publications in the Manpower Studies series:

Manpower Studies No. 1: The Pattern of the Future

Manpower Studies No. 2: The Metal Industries

Manpower Studies No. 3: The Construction Industry

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# Introduction

This Report has been prepared at a time when the use of computers and automatic data processing systems is just getting into its stride in British offices. The scope for further use of computers in offices is wide and in technical terms men are now looking ahead to developments which could make even the compactness, versatility, and speed of today's equipment seem elementary by comparison. That, however, lies some distance in the future.

Two things should be made clear about the present report. The first is that it tries to look ahead only as far as the mid-1970s; it is not a dissertation on the more remote future. The second is that it is concerned primarily with manpower aspects—with what has happened to staff whose work has been transferred to A.D.P., and what the longer-term effect will be on office employment as a whole, in numbers, organisation, and quality of staff.

The field of office employment examined in the survey covers broadly the administration of private and public business, which includes such jobs as compiling statistics, maintaining records, preparing payrolls, making out invoices and accounting. The effects observed were of using computers for this type of work—a procedure referred to in this report as automatic data processing or A.D.P. This field of office employment covers a vast range of activities in commerce and industry, national and local government and other spheres. It includes management, supervisors, clerks and secretaries, typists, machine operators, telephonists, messengers and others.

At the top of this structure A.D.P. offers a new, vital tool of management efficiency: at the other extreme its impact might be regarded as little more than an interesting development of existing work. It is in the middle that a mixed blessing is most likely to be felt, in that the prospects of greater business prosperity and relief from drudgery are balanced by thoughts of possible risks of substantial unemployment. This is to over-simplify; but the broad position taken in this report on office manpower is that top management is significant to its theme mainly in providing the impulse behind

the increasing use of A.D.P.; it is in the range from middle management to machine operators that the effect on manpower resources is most significant. Also at this level are found the growing body of employees for planning, supervising and ministering to A.D.P. systems.

One of the features of any advanced economy is growth in the number of clerical and similar workers—a growth which has progressively been absorbing more and more of this country's working population. In 1921 clerks, typists and office machine operators were 7.2 per cent. of all workers, in 1931 they were 7.3 per cent., in 1951 10.8 per cent. and by 1961 they had increased to 13.1 per cent. Likewise, the proportion of administrative, technical and clerical workers in manufacturing industries has risen from 16 per cent. of the total employees in October, 1948 to 23.1 per cent. in April, 1964. Between 1953 and 1963 the total working population in Great Britain increased by only 0.7 per cent. per annum, but the office labour force rose by about 3 per cent. per annum. Figures 1 and 2 overleaf show the rising proportions of office workers and statistical data is in Appendices 1 and 2.

It is only recently, with the wider use of A.D.P. and other new forms of office mechanisation, that people have begun to seek some modification of these trends. There are some who have looked to A.D.P. to relieve the mounting pressure on office work and its ever increasing demands of men and women and space. Since this enquiry began the Ministry of Technology has been set up, with special responsibility for the computer industry. In office employment A.D.P. is by no means the only development affecting productivity, but it is undoubtedly the most spectacular and causes the most speculation.

## The Questions and the Survey

The questions that are being asked are numerous and diverse, but they mainly centre around the impact of A.D.P. on office jobs and the nature of A.D.P. work as a new form of employment. On the first of these topics the questions are such as

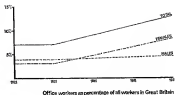


Figure 1

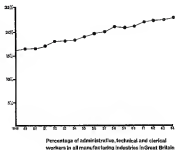


Figure 2

these. How quickly is A.D.P. advancing? What sort of work can it do? What further scope has it? Is it indeed a threat to jobs in offices? Or is it, on the other hand, a means to reduce a staff shortage? What happens to those office employees who are displaced by A.D.P.? How many office employees is it in fact displacing and what is the trend likely to be in the future? How can management best handle the change-over to A.D.P. so as to minimise its repercussion on staff?

On the second topic, the nature of A.D.P., the questions are perhaps more precise. Is A.D.P. creating new occupations? If so, what is the employment like and what are its prospects? What special abilities and training does A.D.P. demand? Are there difficulties in recruiting suitable staff?

Although a number of useful studies of A.D.P. have been made, such as those conducted by the Governments of the U.S.A., Canada and Australia,

and by the International Labour Office and by certain groups in this country, comparatively little research has so far been done on the actual numbers and types of jobs taken over, replaced or created by A.D.P. Moreover, A.D.P. has a special place in the wider debate that is going on at present about all that is meant by 'automation'. It was in these circumstances that the Ministry of Labour's Manpower Research Unit set out to investigate what is happening in some detail as the fourth in its series of Manpower Studies. The enquiry, which was made by questionnaires (reproduced in Appendices 18 and 19 of this report), and by direct discussion, had the co-operation of about two-thirds of all the firms and organisations in Great Britain who had computers installed or on order for office work at 1st January, 1964. Thus, though the report represents no more than the first survey made in a rapidly developing scene, the material on which it is based is by no means narrow. An analysis of the coverage is in Appendix 17.

### The Main Issues

In the course of a survey such as the present many themes offer themselves for examination in considerable detail. It is also necessary to turn aside from time to time to point out the limitations and reservations to which various parts of the evidence must be subject. It may therefore help the reader to follow the steps of the analysis attempted later if at this stage the central points are set out without elaboration.

The computer with its attendant systems and equipment is still no more than a piece of office machinery thriving most where it can be brought to bear on a vast number of detailed facts and calculations which need to be analysed and presented with great speed and accuracy. Thus its commoner applications in office work were found in accounting and statistics, invoicing and billing, stock control and payroll operations. Compared with these more routine uses it has so far made little headway as an aid to more sophisticated and constructive tasks such as production control and the promotion of better forms of management. And in all these uses, even though A.D.P. provides a quick and logical analysis of information, the exercise of human judgment is still constantly needed to apply the information to practical purposes. Moreover, there is a vast amount of office business which must be conducted personally—salesmanship, the discussion of business, the writing and typing of individual letters, secretarial work—and these as far as can be foreseen at present are unlikely to become amenable to automatic methods to any great extent.

Since 1962 A.D.P. in office employment has been advancing at an average rate of rather less than 200 installations a year, until by January, 1965 there were over 600 computers in use.

The number of staff actually discharged as a result of the introduction of A.D.P. on this scale appears to have been virtually negligible and though the redeployment of staff has been fairly extensive in the limited areas affected, this too has been achieved without much difficulty. The reasons for the comparative absence of disruption have been the length of time which A.D.P. takes to install, the predominance of women employees with no firm attachment to an office career, and the fact that in many cases A.D.P. took over from punched card systems and much of the impact of mechanisation had been absorbed previously.

But perhaps the main reason why the transition has been comparatively untroubled is that it has been associated with a general expansion of business in the concerns which have been introducing A.D.P. This association raises a number of related questions about how far A.D.P. has itself been the instrument of the expansion, and how far the expansion was being achieved at the expense of concerns which had not gone in for A.D.P. The second of these questions, however, presents a subject for study that goes much wider than the immediate objectives of the present survey.

Although discharges of staff have been very few and the disturbance caused by redeployment has not been great, the effect of A.D.P. on office posts is a different and much more complex issue, because A.D.P. systems have not only taken over a number of jobs which existed before they were installed, they have also absorbed work subsequently which would in other circumstances have provided jobs for people. On the other hand, A.D.P. has created a large number of new office posts, such as for data processing managers, systems analysts, programmers, and machine operators. The net effect of A.D.P. up to 1st January, 1965, as a very broad estimate, has been a reduction in the total number of office jobs which would otherwise have been available, of about three-quarters of 1 per cent.

Of the new types of occupation which A.D.P. has created in the office, systems analysis and programming—the operations which analyse the work of the office and devise the best means of applying A.D.P. to it—are perhaps the most significant. Both types of employee are likely to be scarce and this may affect the rate of growth of A.D.P. unless careful planning is given to their recruitment and training.

Looking to the future, the general weight of the evidence suggests that A.D.P. will not produce any great changes in office employment over the next five years. Because of the length of time that these systems take to plan, install and organise, the pattern is fairly predictable over that period and management will generally have adequate room for manoeuvre in redeploying staff.

Beyond 1970 the picture may be rather more

complex. At the present time many of the conditions exist for a wide and accelerated spread of A.D.P. in British offices. For one thing, only a small part of the current potential field—perhaps as little as a tenth—has so far been developed. For another, on the evidence collated in the present survey, the uses to which A.D.P. has hitherto been put are on the whole of a fairly routine nature. Also, the decision to invest in A.D.P. has seemed largely to depend on immediate needs—existing equipment has become obsolete, or staff or office space was hard to find, or costs of processing had to be cut down. But there are signs now that among those who have to take the investment decisions there is a growing realisation of the potential of A.D.P. The significant influences on the future do not all tend in the same direction, as is usual in such matters, but the main trend seems clear, and this indicates that by 1975 A.D.P. might have taken over as much as 9 per cent. of all office work. Nevertheless, since the amount of office work is increasing, it seems likely, on current trends, that even by 1975 the number of additional jobs being created in the office will still be more than those being taken over by A.D.P. Much depends on the rate at which business continues to expand, but even if A.D.P. were ultimately found capable of making a substantial reduction in the total number of office employees, the pace of installation of these complicated processes is unlikely to quicken to the extent that redundancy cannot be foreseen in time to allow its absorption without widespread hardship to office workers. The most probable effect over the next decade will be that the more extensive and comprehensive use of A.D.P. systems will offer a small but significant relief to the general shortage of manpower.

# Note on the meaning of terms used

These notes explain certain terms used in the report, particularly those which do not have a precise meaning in general use:

- Computers:** as defined in British Standard 3527:1962 (i.e. any device capable of automatically accepting data, applying a sequence of processes to the data, and supplying the results of these processes). But in order to concentrate on computers large enough to have a pronounced effect on office jobs, calculators of the type which have a small store and programme set up by plugboard or similar device were excluded from the enquiry.
- Automatic data processing (A.D.P.):** is used in this report only for the processing of office work which involves a computer.
- A.D.P. system:** the whole means by which the processing is done, including both machines and methods.
- A.D.P. installation:** a group of A.D.P. machines, mainly independent of any other group of machines and containing at least one computer.
- A.D.P. organisation:** a company, authority or government department who have at least one computer installation set up or planned.
- Office employment:** broadly the work of administering private or public business. It includes processing of statistics, stock control, payroll, production control, critical path analysis, invoicing, billing, accounting, maintenance of records, costing and other work of a similar nature. It does not include design calculations, research and scientific work. Service bureaux (i.e. organisations set up to do data processing for others) were also excluded from the enquiry (except at a few points specified in the report), because they would need different methods of study and raise separate issues.
- Office workers:** those engaged in office employment, mainly in classifying, recording, evaluating and storing data, together with management and services, such as typing. Designers, draughtsmen, scientists and salesmen were not included.
- Area affected by A.D.P.:** includes staff whose work is changed by A.D.P., and also, because the definition in the questionnaire was made flexible to assist replies, some staff associated with the work transferred to A.D.P. whose jobs are affected little or not at all. It is broadly the area in which the advent of the computer has some repercussions.
- Size of A.D.P. installation:** the terms 'large', 'medium' and 'small', were determined by assessing the approximate capital cost of the A.D.P. machines in each installation (excluding data preparation equipment) and classifying as follows:  
Large installation—over £500,000,  
Medium installation—£100,000 to £500,000,  
Small installation—under £100,000.  
This placed most installations in the medium range and enabled the very large and very small ones to be distinguished for separate study where necessary.



## General

### The uses and characteristics of computers

1. Although an electronic computer is in essence a piece of machinery with no initiative of its own, it surpasses by far any previous equipment in that it can be made to do some of the routine work of the human brain. It will undoubtedly be a major instrument of control in industrial processes, communications, transport, administration, commerce and all that can be broadly called automation. In the present study a part of this new technology has been examined: the effect of computers on office employment.

2. The computer, as used in the office for automatic data processing (A.D.P.) can work with enormous speed and accuracy through long series of calculations, set in advance by human agency. It can also be switched quickly from one task to another. Since

these attributes lie at the root of a large part of business efficiency, the rate of advance of computers in British offices, on the evidence brought to light by the present survey, cannot be considered to have been particularly dramatic so far.

### Extent of use of A.D.P. in offices in Great Britain

3. The theory of the computer was foreshadowed by Charles Babbage's 'analytic engine' which was conceived as far back as the first half of the nineteenth century. The modern electronic computer

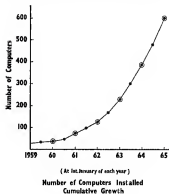


Figure 3.

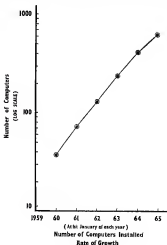
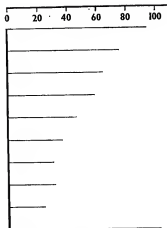


Figure 4.

Insurance, Banking and Finance  
 Engineering and Electrical Goods  
 Public Administration  
 Nationalised Industries  
 Chemical and Allied Industries  
 Distributive Trades  
 Vehicles  
 Food Drink and Tobacco  
 Metal Manufacture  
 All other Industries



**Number of A.D.P. Installations by Industry**  
**Figure 5.**

dates from about 1945 and in Britain it was first used for office work towards the end of 1953. The rate of introduction of A.D.P. systems into office work built up slowly until 1958 but gathered some momentum around the middle of 1959, and the numbers rose to about 300 by mid-1963. The number of deliveries in 1963 was 162 and the number reported to be delivered in 1964 was 215. Machine manufacturers confirm that orders taken in 1964 and 1965 have shown increase in demand. The cumulative growth in deliveries is shown in Figure 3 and Appendix 16, and the rate of growth in Figure 4, these being based, as is this report generally, on computers installed or on order at 1st January, 1964. Computers previously withdrawn from service or ordered subsequently are excluded. In addition to this growth in numbers computers have been generally increasing in power. The position on 1st January, 1964 was that 472 organisations were using, or had on order, computers for office work at 562 A.D.P. installations, which included in all 703 computers. Of the 562 installations, 177 were small, 361 medium sized and 24 large; and of the 703 computers, 390 were installed and 313 on order.

In addition, service bureaux had 47 computers installed and a further 11 on order.

4. The areas of Great Britain and the types of activity in which the spread of computers has so far been greatest are also of some significance. About 20 per cent. of all A.D.P. installations on 1st January, 1964 were in public administration and nationalised industry. Approximately a further 30 per cent. were divided among the insurance, banking and finance group, and the engineering and electrical goods industries. A full analysis of installations and computers by industry Order group is shown in Appendix 3 and illustrated in Figure 5. Geographically, about half of all the A.D.P. installations were in London and South-East England, and approximately a quarter were in the Midlands and the North-West of England. An analysis based on Ministry of Labour regions is shown diagrammatically in Figure 6, with statistics in Appendix 4.

5. Attempts to find comparable data on the number of office installations in other countries have shown only that available information is too unreliable to

provide comparisons. Reports do not say whether 'computers' include small calculators, of which there were over 1,000 in Great Britain on 1st January, 1964 and which were excluded from the figures quoted above and from the rest of this enquiry. Nor do reports generally define such points as the source of their information, the precise point in time to which their figures relate and whether or not scientific, research and process control computers are included. Some of the overseas reports provided by different authorities showed variations as high as 100 per cent. between figures purporting to give the same facts. Where analyses included 'computers installed in United Kingdom' they were found to deviate as much as 30 per cent. from the figures already quoted and in one instance to include computers exported from this country.

#### Reasons for installing A.D.P.

6. Most of the organisations who took part in this survey gave reasons for acquiring A.D.P. installations. Since many of them were still developing systems, it must be emphasised that this information primarily presents a picture of intentions and is not a retrospective evaluation of results, although most of those who were in a position to judge said that their expectations were being fulfilled.

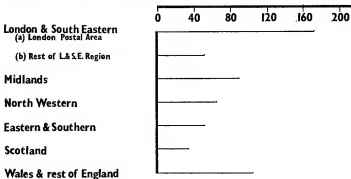
7. *Prime reasons for installation.* Nearly a third of the organisations specified a prime reason for

acquiring A.D.P. or gave only one reason. About three-quarters of the reasons consisted of the following in roughly equal proportions:

- (1) to replace worn-out equipment;
- (2) to provide better service to management;
- (3) to reduce the cost of processing data (largely a matter of staff costs).

The full analysis is depicted in Figure 7 and set out in Appendix 5. Savings in manpower relate only to those cases in which there were indications of difficulty in recruiting staff. Savings in manpower in order to save expenditure on salaries were classified as savings in cost. Similarly, savings in space related only to cases in which there had been difficulty in finding or expanding office accommodation.

8. *All reasons.* Some respondents gave more than one reason for acquiring A.D.P. and a straight analysis of these, while not a measure of their relative importance, gives some indication of the prevalence of certain factors in the minds of those who install computers. The most frequently mentioned reasons were speed of processing and saving in data processing costs, followed by better service to management and better quality results. The term 'better quality results' includes increased accuracy and covers such general statements as 'the computer would do the work better.' Where some definition was given, such as 'will do the job better



Number of A.D.P. Installations by Ministry of Labour Regions

Figure 6.

by giving management more information' the statement was classified only as better service to management. The results of the analysis are depicted in Figure 8 and statistics are given in Appendix 6.

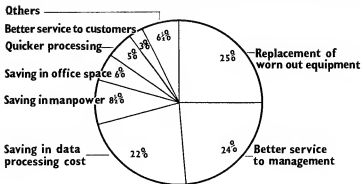
9. It will be seen that among the reasons for installing a computer are three which represent some degree of compulsion—the need to save manpower, or to save office space, or to replace worn-out equipment. It is perhaps significant that of the prime reasons given, over 40 per cent. were among this group. Even in the analysis of all reasons, which did not allow for relative weighting, the compulsive reasons amounted to some 23 per cent. The conclusion must be that a considerable number of computer users did not enter the field of A.D.P. voluntarily, but were impelled by the course of events.

10. It was evident that many computer users had been reluctant to make a voluntary and objective examination of the advantages of using a computer. In some organisations such an investigation was normal practice and included a meticulous costing of alternative possibilities. This was particularly so in government departments, where orders for computers had usually to be justified on a basis of savings in data processing cost alone. More widespread initiative in making an open-minded evaluation

of the possible advantages of using a computer might lead to much expansion in their use, particularly in industry and commerce where the opportunities of obtaining benefits from improvements in production control, costing and management information might increase the profitability of a computer, even to the point of disposing of existing office machinery before it was worn-out.

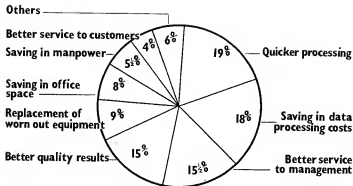
11. *Trends.* It has sometimes been said that users are now motivated by the desire to 'run the business better' (by which is usually meant the provision of better management information) rather than by the desire, as previously, to save data processing costs, including staff costs. Study of this aspect of the matter during the present survey led to the conclusion that there had in fact been no significant change over recent years in the reasons for acquiring A.D.P.

12. Whether or not a change in approach will develop must be a matter of speculation. The present survey has indicated that there is a current tendency for the desire to use computers to snowball. Several newcomers to this field said they had been drawn towards it because some other firm had preceded them. It was not simply a matter of business competition, but a feeling that computers, having at first been looked upon with some suspicion,



**Analysis of prime reasons for installing A.D.P.**

**Figure 7.**



**Analysis of all reasons for installing A. D. P.**

**Figure 8**

were now becoming accepted as part of normal office equipment. This tendency could lead to a broader appreciation of computers, an extensive recasting of the reasons for acquiring them and a general upsurge in the numbers installed; although, because of the length of time it takes to set up an A.D.P. system, the effects would not be generally felt for some years. This factor is examined in greater detail later in this report.

#### **Uses to which A.D.P. is being put**

13. The work which is now being undertaken by A.D.P. in offices can be grouped as follows:

(1) Management accounting and statistics; this covers all accounting and statistical work done in order to run the business, and includes, for example, any such work specifically described as 'for management', as well as costing and sales analysis. The present report will refer to this group simply as 'management accounting.'

(2) General statistics; this covers statistics produced for reasons other than those given in (1) above. Much of the statistical work of national and local government is in this category.

(3) Financial accounting; this covers accounting work not included in the first item, such as the maintenance of customers' accounts by banks, and much of the accounting done by insurance com-

panies, finance houses, and gas and electricity boards.

(4) Production control, such as planning the supply of materials for assembly. (The direct control of industrial machines by computers, generally known as process control, was excluded from the survey.)

(5) Stock control, including maintenance of stores records and replenishing of stocks.

(6) Invoicing and billing, which is often closely linked with stock control and financial accounting.

(7) Payroll work, including any connected maintenance of personnel records.

(8) Miscellaneous work; this includes timetable planning, share registration, critical path analysis, preparation of rosters and any other jobs not numerous enough at this stage to justify separate classification.

14. *Work now being undertaken.* All the organisations who helped with this survey listed the types of work they were processing or intending to process by A.D.P. without commenting, however, on the degree of priority between the various types or on the dates of the transfer of particular jobs to A.D.P. A straight count of all these references showed that payroll was most frequently included in current A.D.P. plans, followed closely by management



**Uses of A.D.P. — Number of Applications  
in each main Category of Work as  
Percentage of Total Applications**

**Figure 9.**

accounting. A fuller picture of these findings is found in Figure 9 and the aggregates from which they were derived are given in Appendix 7.

15. About 20 per cent. of the respondents were processing a substantial amount of work on A.D.P. and provided an analysis of how the computer time was being spent. This showed that their total time was divided between financial accounting, payroll, and management accounting on a basis of about one-fifth each, with stock control, invoicing and billing, general statistics and production control in smaller proportions. This is illustrated in Figure 10.

16. *Industrial analysis.* An examination of particular industries showed that the types of A.D.P. work developing in each were on the lines expected. For example, production control applications were most numerous in iron and steel and motor vehicle manufacturing; billing in local government and electricity and gas supply; financial accounting in insurance and banking; and general statistics in local and national government.

17. *Trends in usage.* The types of work done on, or planned for, computers were analysed on the basis of their installation dates. There is no indication of any substantial change over the period 1958 to 1965 in the work for which computers have been acquired. Further analysis of work currently being processed by the more mature installations and of work being planned by installations still under

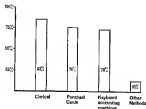
development again shows little variation in the general pattern of work, either in the relative numbers of applications to particular types of work or in the proportion of total computer time devoted to each of them. There is little sign of any development away from the processing of the popular computer jobs, like payroll, to the more advanced systems of production control and management accounting. While this is undoubtedly taking place in some installations, there is no evidence of any general trend in this direction.

18. A significant reason for this consistent pattern of processing may be the fact that most organisations which have so far acquired computers have been limited by the circumstances in which the computers were bought. Since a large number of computer users installed a computer to replace office machinery which was worn out, or to save office space, or to meet a shortage of manpower, they had to concentrate on work which met these objectives. Other organisations were limited by the nature of their business. Moreover, the computer is an expensive machine and there is generally pressure to make sure that it is fully occupied. These factors have no doubt caused users to concentrate on the jobs which contain the largest quantities of repetitive straightforward processing and to postpone the more advanced applications whose profitability may be more speculative and indirect. Whether or not this pattern of use will continue, depends to some extent



**Uses of A.D.P. — Time spent on each main  
Category of Work as Percentage of  
Total Time**

**Figure 10.**



Percentage of installations who reported some supersession of the above methods by A.D.P.

FIGURE 11.

on the amount of work of the mass-repetitive type yet to be transferred to computers and on whether the purchasers of A.D.P. equipment in the next few years will be newcomers to this field or existing users seeking to exploit new applications. These factors, which have an important bearing on the longer-term trends are referred to further in the concluding chapter of this report.

#### Methods superseded by A.D.P.

19. Most respondents gave some account of how the work had been processed before it was transferred to the computer. In the main, the methods superseded had been clerical, punched cards, and keyboard accounting machine methods. The majority of A.D.P. users gave a mixture of all three. Of the 328 organisations who provided information, 270 said that some clerical work had been taken over, 249 reported some transfer from purely punched card processing, and 229 had replaced keyboard accounting machines to some extent. There were only 43 reports of other methods being superseded and these referred mainly to addressing machines and plug-board calculators, the latter being for the most part supplementary to punched card systems. Comparatively few had changed over from an earlier computer system, although in time this kind of development will obviously increase. These findings are illustrated in Figure 11 and a fuller statistical analysis will be found in Appendix 8.

20. Twenty-nine respondents also referred to new work in which A.D.P. was being used for substantial jobs which had not been undertaken at all before. These included quality control, sales forecasting, inventory planning and the graduated pension scheme, and it is probable that there are other such instances which did not come to light.

21. Where the work taken over by a computer

involved more than one previous method, no attempt was made in the survey to find out the proportion of work taken over from each, but some indication of the manpower effects will be found in Chapter II, paragraph 8 of this report, which deals with the nature of office posts which have been superseded by A.D.P.

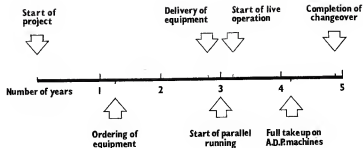
#### Time taken to install A.D.P. systems

22. The length of time taken to set up an A.D.P. system has a direct bearing on the problems of redeployment of staff, including the problem of clearing redundancies. It was particularly evident in the survey that the reorganisation of staff was not confined to any set time but was a continuing responsibility throughout most of the stages described in the following paragraph. Even where, exceptionally, it was known that some re-arrangements of staff would have to take place at short notice there was scope for planning to meet the contingency well in advance by reducing recruitment, for example, or by engaging temporary staff.

23. The length of time taken to install an A.D.P. system has been divided for the purpose of this survey, into the following six periods:

- (1) The start of the project (i.e. the point at which the first serious examination is made of the possibilities of using an A.D.P. system) up to the ordering of the equipment;
- (2) The ordering of the equipment (i.e. when a formal order is placed and work proceeds on detailed planning and programming) up to its delivery;
- (3) The delivery of the equipment up to the start of parallel running (i.e. the point at which the A.D.P. system first operates on authentic data while the previous system is still operating, in order to prove the accuracy of the A.D.P. system, usually by some comparison of results);
- (4) The start of parallel running up to the time of live operation (i.e. the point at which the A.D.P. system alone first undertakes real processing);
- (5) Live operation up to full take-up (i.e. when the A.D.P. system, which may have been run in parallel and transferred to live operation piecemeal, is wholly on live operation);
- (6) Full take-up to complete change-over (i.e. the point at which the A.D.P. system is finally established and all that was superseded, including clearance of any staff redundancies and re-organisation, has been fully resolved).

24. At 251 installations giving information for the survey the time taken or expected to be taken for the setting up of an A.D.P. system through all the stages (1) to (6) averaged about five years. An analysis of the separate periods is given in Figure 12 with further detail in Appendix 9. The shortest overall timetable reported, from the start of the



**Average time taken to set up an A.D.P. System**

**Figure 12**

project to complete change-over, was 15 months, and the longest 16 years. There was a correspondingly wide variation in the complexity and size of A.D.P. projects, ranging from the installation of a small computer to take on little more than had previously been done by punched card tabulators to the establishment of a nation-wide network with many computers in different parts of the country.

25. The size of an A.D.P. installation had a considerable bearing on the time taken to set it up. The small installations took in all an average of 48 months, medium sized 60 months and the large ones 80 months. An examination of time-tables against dates of computer delivery showed that, with the exception of a few very large systems taking an exceptionally long time to install, no marked change had been taking place in the length of time taken to set up A.D.P. installations, and there is no sign that there will be any great alteration in this respect in the foreseeable future. This is because the time needed for planning, reorganisation, systems analysis and programming mainly determines the time-table, including the period between ordering the computer and its delivery. Even the change-over from one computer to another usually calls for a major reorganisation of the system of processing to make the best use of the Inter machine.



## Effect of A.D.P. on Office Employment Generally

### Employment effects

1. A.D.P. in offices has so far made very little impact on employment as a whole. This is illustrated in the comparisons made in Figure 13 and Appendix 10, which show that in relation to the total working population the number of persons in the areas affected by A.D.P. is less than 1 per cent.

2. The work of offices is affected by A.D.P. in different ways according to the manner in which it was done previously. The greatest changes occur when the transition is from clerical methods, because in these circumstances it is usually necessary to set up a machine section to punch and verify cards or paper tape, for which work mostly women are recruited. The clerks displaced often come from the more routine jobs, but they may be retained as machine operators, either on data preparation or in the computer room. The change-over from a system based on punched cards normally requires much less re-organisation. The machine operators on data preparation mostly continue with little alteration in their work and the displacement of clerks tends to be less. In these circumstances, broadly speaking, much of the alteration in the nature of work will have been experienced at an earlier stage when the change-over was made from clerical to punched card procedures. Sometimes an A.D.P. system takes over from keyboard accounting machines, and then the machine operators may be retrained for punching cards or tape for the new system. Occasionally it is necessary to offer typists similar retraining when a job such as invoicing or billing is transferred to A.D.P.

3. Although, as will be seen, the number of employees actually discharged because of the introduction of A.D.P. has been small, a number of complicated factors affect the balance between jobs lost and jobs added. The chief of these factors may be summarised thus:

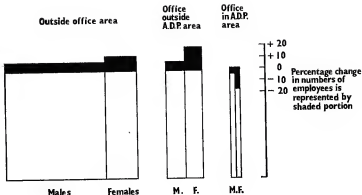
- (1) Organisations installing A.D.P. were on the whole expanding their business and the job-saving impact of the installation was largely off-set by a general rise in the numbers employed;
- (2) A.D.P. was directly creating a number of additional jobs for its own technical operation;
- (3) A.D.P. was undertaking increases in work without extra staff, the performance of which would otherwise have required considerable additions of staff;
- (4) Some of the work done by A.D.P. would have been considerably changed in content or not done at all if A.D.P. had not been installed;
- (5) Because the installation of A.D.P. took on average about five years the processing needs of



- Area of square A — total working population  
 Area of square B — total employees of organizations with A.D.P.  
 Area of square C — office workers in organizations with A.D.P.  
 Area of square D — office workers in areas affected by A.D.P.

Relative size of A.D.P. Area.

Figure 13



Changes in size of average A.D.P. Organisation during changeover to A.D.P.

Figure 14

the organisation usually altered considerably during the change-over.

The first two of these factors enable employees who would otherwise become redundant to be absorbed into the new posts created, either directly because of the growth of the new A.D.P. occupations, or indirectly because of the general expansion of business. Some attempt is made in this chapter to assess these various factors in the light of the facts and figures assembled in the course of the present survey. These estimates, which are necessarily broad, represent the position for the whole of Great Britain, except where the context indicates otherwise. It should also be particularly noted that although the employment effects are described below in the past tense, e.g. posts taken over by A.D.P., posts created, they generally include not only what has actually occurred, but also what was expected to arise from the introduction of all computers installed or on order for A.D.P. on 1st January, 1964. Because of the time needed to set up A.D.P. some of the latter effects may not yet have materialised.

#### Effect on numbers of staff employed

4. *Staff actually discharged.* Some conclusion about the rate at which A.D.P. has led to actual discharge of staff can be drawn from the fact that of the 331

organisations who dealt with this subject in their replies, only 13 were found to have discharged staff as a result of installing computers. In each case the employees discharged were few in number and where figures were given the average was less than 10 per installation. A further 19 organisations foresaw a possibility of having to discharge staff in the future, when their computers were installed, but most of them also said that the numbers would be few. Of these 32 organisations, 12 were moving work to another place for computer processing, and this might be taken to aggravate the difficulty of finding another job for employees who were affected. In general most of the staff discharged were women and included married women and part-time employees.

5. *Effect on total employment in offices.* In general, the volume of business in the organisations installing A.D.P. was rising and creating a demand for more office staff outside the A.D.P. area. The net effect during the course of the installation of the average computer project was an overall rise in the total number employed in the office by about 8 per cent. In the office area not affected by A.D.P. it rose by about 12.5 per cent. Within the A.D.P. area the number of staff fell by about 10 per cent., which, in the average A.D.P. organisation, amounted to about 40 employees. These changes are illus-

trated in Figure 14. The number of employees involved are shown later in Table 6.

6. *Proportion of male and female workers affected.* The fall in the numbers employed in the area affected by a computer was made up, on the average, of a reduction in the number of males by 4 per cent. and females by 16.5 per cent. At the same time, in the office area not effected by A.D.P., where the numbers of staff were generally rising, there was also a marked preponderance of women among those engaged. Whereas the office was composed of some 53 per cent. males and 47 per cent. females, at the start of the project, engagements during its course averaged 28 per cent. males and 72 per cent. females. Thus, on balance, although the reduction in the A.D.P. area was mostly among female staff, the overall effect in offices was still to produce a rise in their numbers.

#### Effect on numbers of posts

7. It is necessary to be clear throughout this analysis that there are two distinct strands. The first is the difference between the actual numbers employed before and after the introduction of A.D.P. The second is the effect of A.D.P. on the numbers of posts after A.D.P. has been installed, compared with the number there would have been without A.D.P. This latter calculation has a number of elements:

- (1) The office posts created outside the A.D.P. area as a consequence of the expansion of business during the introduction of A.D.P.;
- (2) The extra posts that would have been needed in the A.D.P. area to cope with the expansion of business, if A.D.P. had not been available to deal with it;
- (3) The additional posts created for the technical operation of A.D.P. (e.g. for programming);
- (4) The posts which were actually discontinued in the A.D.P. area.

The sum of the numbers of posts in (2) and (4) above is called in this report the 'posts taken over by A.D.P.' The posts in (3) above are referred to as 'posts created by A.D.P.'

8. *Posts taken over by A.D.P.* Some of the posts taken over by A.D.P., having arisen from increased business, have never in fact been filled by persons, because the work was put straight on to a computer as it accrued. A number of employers said that this growth in their business was partly the result of having a computer, their ability to expand having previously been limited by their inability to find enough staff. There was also new work which could not have been done by other methods because it would have taken too long or cost too much.

Moreover, the standard to which some work was done would have to be reduced if computers were no longer available. All these factors need to be borne in mind when comparison is made between A.D.P. and other means of processing data. The work done by a computer tends to represent more jobs than would arise if it were not there. Currently the difference in terms of manpower is small but in the longer term the factor may become more important, particularly if A.D.P. reduces the costs of goods and services and thereby increases the demand for them.

9. It is estimated that the total numbers of posts taken over by A.D.P. (as defined at the end of paragraph 7 above) were as shown in Table 1. The method of assessment is stated in paragraph 15 of this chapter.

Table 1—Estimated number of jobs taken over by all A.D.P. installations with computers installed or on order at 1st January, 1964

Occupation	Males	Females	Total
Managers and supervisors	620	80	700
Clerks .. ..	13,100	20,200	33,300
Office machine operators (non-A.D.P.) .. ..	400	14,200	14,600
Typists .. ..	5	2,395	2,400
Total .. ..	14,125	36,875	51,000

(Excluding service bureaux and computer manufacturers' services to customers.)

10. The proportion of females to males does not necessarily reflect a preference for female staff for these jobs, but possibly the fact that more women than men were available for them. The clerical work involved was mostly of a routine type, much of it being what has been described by some employers as the 'drudgery jobs.' The office machine operators were mostly concerned with keyboard accounting machines and addressing equipment.

11. A large proportion of the posts taken over by A.D.P. was in three industries, about 10 per cent. in national government, 20 per cent. in banking, insurance and finance, and 10 per cent. in gas and electricity boards. Two-thirds of all posts were in London and South-East England.

12. *Posts created by A.D.P.* Against the jobs taken over by A.D.P. should be off-set those which A.D.P. has created, such as posts for programming, systems analysis and machine operation. It is estimated that the numbers of these posts created in the main occupations at all installations with computers installed or on order at 1st January, 1964, are as shown in Table 2. The nature of these new jobs is dealt with more fully in Chapter III.

Table 2—Estimated numbers of posts created in all A.D.P. installations with computers installed or on order at 1st January, 1964

Occupation	Males	Females	Total
Data processing managers	560	5	565
Systems analysts .. ..	830	20	850
Programmers .. ..	1,850	470	2,360
Machine operators (A.D.P.)	950	3,775	4,725
Total ..	4,230	4,270	8,500

(Excluding service bureaux and computer manufacturers' services to customers.)

13. As the numbers of jobs created show the position (or expected position) when the initial transfers of work to A.D.P. have been completed, the systems analysis and programming posts shown in Table 2 are for maintaining systems and programmes up to date. Since many of the projects are currently in a transitional stage, and the initial systems and programmes are still being developed, the numbers of these posts at 1st January, 1964, were considerably greater, as shown in Table 3. Also the numbers of machine operator posts shown as created in Table 2 (and later in Table 6) include only new jobs. Where machine operators were employed, for example, on punching cards for an earlier punched card installation and continued with similar duties for A.D.P. they were excluded from these figures: but any additions to or reductions in the numbers of these posts at individual installations were included in the assessments. Estimates of the total number of machine operators employed on A.D.P. on 1st January, 1964, are shown in Table 3. In addition, the numbers of A.D.P. staff employed at service bureaux and on computer manufacturers' services to customers in July, 1964, are shown in Table 4.

Table 3—Estimated numbers of staff employed on 1st January, 1964, at all A.D.P. installations with computers installed or on order

Occupation	Males	Females	Total
Data processing managers	560	5	565
Systems analysts .. ..	1,460	60	1,520
Programmers .. ..	2,530	560	3,090
Machine operators on data preparation .. ..	225	10,500	10,725
Other A.D.P. machine operators	625	1,975	2,600
Total ..	5,400	13,100	18,500

In addition there were A.D.P. staff engaged in preparing for A.D.P. installations for which computers had not yet been ordered. It is estimated that

they included approximately 350 data processing managers, 800 systems analysts and 450 programmers.

(All the above figures exclude service bureaux and computer manufacturers' services to customers.)

Table 4—Numbers of A.D.P. staff employed at computer service bureaux and on computer manufacturers' services to customers in July, 1964

Occupation	Males	Females	Total
Data processing managers	250	24	274
Systems analysts .. ..	1,228	88	1,316
Programmers .. ..	905	265	1,168
Machine operators on data preparation .. ..	55	807	862
Other A.D.P. machine operators	226	156	382
Total ..	2,662	1,340	4,002

(Of the total of 4,002 employees 1,849 were on service bureaux work.)

#### Summary of effects on personnel and posts

14. The foregoing has dealt firstly, with the effect of A.D.P. on numbers of persons actually employed and secondly, with the effect on numbers of posts, including the jobs which would have arisen if A.D.P. had not absorbed some of the growth in business. These two elements are brought together in Figure 15 and Table 6 (page 22). The figure shows the inter-relationship of the several changes occurring in the numbers of personnel and posts during the installation of A.D.P. in the average A.D.P. organisation. The table gives rounded estimates of the numbers of workers and posts involved in these effects, with cross-references to the corresponding parts of the organisation depicted in the figure.

15. The analysis is based upon information provided for the several calculations by between 23 and 50 per cent. of all organisations with computers installed or on order at 1st January, 1964, together with information obtained from discussions with management, data processing managers and staff, computer manufacturers and others with first-hand knowledge of A.D.P. techniques and their effects. The outcome is considered to give a fair picture of what is happening in the average A.D.P. organisation in Great Britain. The results were obtained by aggregating the changes occurring or expected to occur during the introduction of all office computers installed or on order at 1st January, 1964 (with adjustment for different rates of response to our enquiries in the most significant industries) and dividing by the number of A.D.P. organisations concerned. The averages per A.D.P. organisation can be converted to averages per installation or per computer by applying the total numbers in each

category: these being A.D.P. organisations—472, A.D.P. installations—562, computers—703.

16. It will be seen from the table that the total number of office posts taken over by A.D.P. in the average A.D.P. organisation was 108, which included not only jobs actually discontinued, but those which would have arisen through increasing business had not A.D.P. undertaken some of the extra work. Some of the expansion was in fact due to installing A.D.P., although the effect was not on the whole large. Nevertheless, it needs to be remembered, as stated in paragraph 8 of this chapter, that in all probability if A.D.P. had not been installed the number of additional office posts available would have been slightly less than 108. As it is not possible to evaluate this element more precisely, it has not been shown separately in the current analysis. Among the 108 posts about 70 were clerical and 31 for operating office machines, such as keyboard accounting machines and addressing equipment. About 78 of the posts would probably have been filled by women.

17. These 108 posts taken over by A.D.P. were comprised of some 50 jobs which would have arisen only if A.D.P. had not been installed and 58 jobs which were actually discontinued. The former were assessed, firstly, by calculating how much office work had expanded outside the A.D.P. area in the average organisation, and assuming that, if A.D.P. had not been installed, a similar expansion would have occurred in the A.D.P. area; and secondly, by examining and aggregating the savings in posts stated in reply to item 29 of the questionnaire (which asked for a comparison between the situation with A.D.P. and what it would have been without it). The results of both calculations were within 2 per cent. of each other. The 58 posts actually discontinued consisted of unfilled vacancies or were jobs from which employees moved. There were also many posts which were modified only in detail and these were not numbered among the changes. Many personnel whose jobs were discontinued moved to new jobs arising in the office outside the A.D.P. area or to one of the jobs created for the technical operation of A.D.P. (e.g. programming).

18. The average number of A.D.P. jobs created was 18, 10 of which were for operating A.D.P. machines. The numbers of systems analysts and programmers (about two and five respectively) are the average complement expected to be needed after the initial transfer to A.D.P. has been completed, to keep the system and programmes up-to-date. Hence, the numbers are lower than those currently needed for the large amount of work in process of transfer to A.D.P. In fact, as there is likely to be much continuing activity on transferring work to new A.D.P. systems for a long time to come, the actual number of these posts is likely to be generally larger than is

reflected in the above figures. On 1st January, 1964, the estimated average numbers of systems analysts and programmers per A.D.P. organisation were as shown in Table 5.

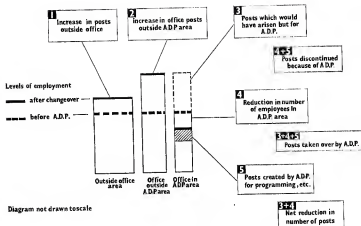
Table 5—Estimated average numbers of systems analysts and programmers per A.D.P. organisation on 1st January, 1964

Occupation	Males	Females	Total
Systems analysts .. ..	3.1	0.1	3.2
Programmers .. ..	5.3	1.2	6.5
Total .. ..	8.4	1.3	9.7

19. The net reduction in the number of posts in the A.D.P. area was 90, but as some of these would have arisen only if A.D.P. had not been installed, the reduction in numbers of persons actually employed in the A.D.P. area was only 40. As 188 extra office posts arose outside the A.D.P. area, however, the net overall effect in the average A.D.P. organisation was an increase of 148 jobs.

20. Individual organisations varied widely from the average because of large differences in sizes of computers, types of work processed, expertise in A.D.P. techniques and numbers of employees in organisations using A.D.P. The range extended, for example, from a small computer to optimise production of a single product to multiple installations with nationwide networks of computers for maintaining customers' accounts. The former application would probably result in a small net addition to the staff, with the cost of the A.D.P. system set-off against savings in production costs and increased sales. The latter application might absorb the equivalent of a thousand or more office posts, the expenditure on equipment, programmes, etc., being largely offset by savings in staff costs. Many variations arose from the fact that few organisations bought a computer for a single purpose and the different combinations of these and other factors mentioned above were very numerous.

21. In addition the effect of some of the large multiple installations was not wholly reflected in the analysis, because they were mainly in the planning stage and most of the computers had not yet been ordered. Each of these installations is expected to contain a number of inter-related computers in various parts of the country, and if they had been included in the analysis on the basis of present expectations, the national averages of posts taken over per A.D.P. organisation and per A.D.P. installation would have been raised by about 15 to 20 per cent., but, so far as can be foreseen, the national average number of posts taken over per computer would probably not have been much changed.



Relationship between the various changes in the average A.D.P. organisation during changeover to A.D.P.  
Figure 15.

Table 6—CHANGES IN POSTS AT AVERAGE A.D.P. ORGANISATION during course of all A.D.P. projects for which computers were installed or on order at 1st January, 1964

Number of posts at start of A.D.P. project	Males	Females	Total	%
Outside office area .. .. .	4,300	1,300	5,600	75
In office—outside A.D.P. area .. .. .	800	700	1,500	20
In office—A.D.P. area .. .. .	200	200	400	5
All posts in A.D.P. organisation .. .. .	5,300	2,200	7,500	100
Number of posts on completion of Change-over	Males	Females	Total	%
Outside office area .. .. .	4,600	1,450	6,050	74.8
In office—outside A.D.P. area .. .. .	852	836	1,688	20.8
In office—A.D.P. area .. .. .	193	167	360	4.4
All posts in A.D.P. organisation .. .. .	5,645	2,453	8,098	100

Table 6—(continued)

Area <sup>§</sup>	Increase in posts outside A.D.P. area	Males	Females	Total	% Rise
1	Posts outside office .. .. .	300	150	450	8
2	Office posts outside A.D.P. area .. ..	52	136	188	12.5

Area	Posts in the A.D.P. area	Males	Females	Total	%*
4+5	Posts discontinued because of A.D.P. ..	16	42	58	14.5
3	Additional posts which would have arisen but for A.D.P.† .. .. .	14	36	50	12.5
3+4+5	Posts taken over by A.D.P.‡ .. .. .	30	78	108	27.0

Area		Males	Females	Total	%*
5	Posts created by A.D.P. for programming, etc.§ .. .. .	9	9	18	4.5

Area		Males	Females	Total	%*
3+4	Net reduction in number of posts in A.D.P. area¶ .. .. .	21	69	90	22.5

Area		Males	Females	Total	%*
4	Reduction in number of employees in A.D.P. area .. .. .	7	33	40	10

Area		Males	Females	Total	% Rise
2-4	Overall increase in total number of office employees .. .. .	45	103	148	8

## Notes:

\* Percentage of number of posts in A.D.P. area at start of project.

† No allowance has been made for business which would not or could not be done without A.D.P.

‡ Detailed analysis is also provided of this item overhead.

§ Area numbers refer to corresponding parts of diagram in Figure 15.

Table 6—(continued)

Area	Analysis of posts taken over by A.D.P.†	Males	Females	Total
3+4+5	Managers and supervisors .. .. .	1.5	—	1.5
	Clerks .. .. .	27.5	43	70.5
	Machine operators (non-A.D.P. machines) .. .. .	1	30	31
	Typists .. .. .	—	5	5
	Total ..	30	78	108

Area	Analysis of posts created by A.D.P.	Males	Females	Total
5	Data processing managers .. .. .	1.2	—	1.2
	Systems analysts .. .. .	1.3	—	1.3
	Programmers .. .. .	4	1	5
	Machine operators (A.D.P. equipment) .. .. .	2	8	10
	Total ..	9	9	18

**Organisation of staffing for the change-over to A.D.P.**

22. Although the effect on posts gained and lost was found on balance not to have created any wide-spread problems in itself, it is clear that much care and foresight are needed if the change-over to A.D.P. is to be made in such a way that staff can be moved to the new jobs without friction and redundancies absorbed without discharging employees. It is therefore worth giving special attention at this point to the problems found and to the solutions that might best be applied to them.

23. Out of 306 replies relating to this part of the survey, about two-thirds showed that some action had been taken to meet staffing problems in advance of change-over to A.D.P. and nearly two-thirds of these organisations had plans drawn up on paper. Many of the other organisations considered that they had not needed elaborate planning because their difficulties had been negligible. In some cases, for example, the computer was not large enough to have any appreciable effect on staffing. In others it had merely alleviated existing staff shortages.

24. Many of the organisations used more than one method of making labour force adjustments. The most common means was through normal staff wastage arising from marriage, maternity, retirement and other such causes. Some 84 per cent. of the installations co-operating in this enquiry used this as one of the means of resolving the situation and were helped by the fact that a large proportion of the jobs taken over by the computer had been occupied by women. About 27 per cent. of the installations had been recruiting temporary staff for some time before the introduction of the computer in order to make it easier to reduce staff as the new

system was built up. In some cases it was found that the temporary staff were still in post a long time after the full transition to A.D.P. About 43 per cent. of the installations reduced staff recruitment in advance, although many had done so only to a minor extent. It was considered that the timing of such measures was particularly important because any delay in the time-table for bringing in the computer could lead to extensive pressure of work. Moreover, while the system was taking over from the previous methods there were periods when both were in operation and this called for rather more staff than normal. It was evident that many firms had met their problems by combining a reduction in the normal recruitment of permanent staff with increased engagement of temporary staff.

25. In about 29 per cent. of the installations, staff had been transferred to jobs in the new A.D.P. systems, including keyboard accounting machine operators transferred to punching cards or paper tape for computer input and other staff retrained as systems analysts, programmers, or computer operators. In 53 per cent. of the installations, staff (mainly clerks and typists) had been transferred to other jobs outside the A.D.P. area. Many of the organisations stated that increases in work from an expansion of their business helped to absorb redundant staff. Statistical analysis of these replies is shown in Appendix 11.

26. Orderly redeployment of staff was more difficult in cases in which work had to be moved to a new place for computer processing, because this movement was apt to leave groups of staff isolated with no new work which they could be offered locally. About 20 per cent. of the installations



reported a change of location in some of the work when they introduced A.D.P. and most of the moves were directly attributable to A.D.P. In many cases the part of the work moved was relatively small. There had been little or no serious repercussions on the staff concerned. Efforts to reduce the effects of redundancy included those already mentioned, but less of the redundancy was cleared through normal wastage (about 32 per cent. of these installations, as compared with 84 per cent. for all installations) and a higher proportion of displaced staff was transferred to another job in the new A.D.P. centre (40 per cent. as against 29 per cent.). This, it was judged, was because the change of location made the transfer of work to the computer more sudden than it would otherwise have been. The effect was to allow normal wastage less time to operate to meet the redundancy, but to give greater encouragement to staff to transfer with the job to maintain continuity. Many organisations went to considerable lengths to persuade their staff to move with them. Inducements included time off (with expenses) to look for houses, talks by local headmasters and other authorities about conditions in the new area, travelling expenses, transfer grants, and help with house purchase.

27. In the few cases where actual discharge of staff was reported, over half the organisations had made severance payments and most of the others had discharged only part-time staff or married women. A similar proportion of organisations had helped their employees to find work elsewhere, and among those who expected to make discharges in the future, the pattern was much the same.

28. In all cases, however, the real significant factor in helping to make the change-over to A.D.P. smoother was the slow speed at which the introduction to A.D.P. had to progress. As this report has already noted in some detail, the average time taken for a computer project to mature is about five years in all, including some 16 months for the actual transfer of work on to the computer. In these circumstances, about a third of the organisations had no difficulty with redundancy because the numbers of staff displaced were small and were absorbed almost automatically by normal wastage. The great majority of those who were faced with a real problem had time to take action in advance to solve it.

29. *Communication with staff.* About 95 per cent. of the organisations who commented on the point had communicated with their staff in advance about the ordering of a computer. The methods of communication varied from posting a notice to extensive programmes of talks, instruction and demonstration. Several organisations published articles in their house magazines. Some arranged for every

employee who might feel in any way affected by the computer project to be interviewed individually in order to discuss the facts of the matter.

30. About 50 per cent. of the organisations had consulted trade unions or staff associations (several others mentioned that their office workers were not represented in this way) and in some cases the employer had first informed the trade union of the decision to acquire a computer and had relied on the union officials to pass on the information to the staff.

31. The timing of release of information to staff was felt by some organisations to be important on the grounds that if it comes too soon it is liable to be speculative in content and to upset staff unnecessarily; if too late, it is preceded by rumours which do much harm. Some employers were able to accompany their announcement with a promise that no member of the staff would lose employment because of the computer. Others, believing that prompt disclosure of the decision to buy a computer might lead to staff resigning prematurely, offered incentive bonuses to those who delayed their departure until the A.D.P. system was developing. Generally, when the time came, no-one was discharged, but in some cases women who would otherwise have left of their own accord earlier, did delay their departure and collected their bonus, thereby helping the change-over to A.D.P.

#### **Effect on the structure of office staffs**

32. One of the fears sometimes expressed about A.D.P. is that it will alter the structure of office staff in such a way that, while there will be an increase in the number of machine operators in the lower levels of the hierarchy and to a lesser extent of executives in the upper levels, the numbers in the grades in the middle will sharply decrease. This, it is supposed, would create an awkward blockage to promotion between the lower and upper levels of the hierarchy. Although the survey confirmed that there had been some movement of this sort in the numbers of staff, it was not so large in the office as a whole as to create much difficulty. In fact diagrams constructed to show the position in the average office before and after the event were almost indistinguishable. Moreover, there are two factors which tend to prevent serious trouble. First, the status of machine operators has risen with the installation of A.D.P., particularly in the computer room; and secondly, the turn-over rate among machine operators is very high and only a few of them look for a career in the office. It would, perhaps, be a fair statement to say that, while there might conceivably be isolated cases of difficulty where blocks of routine clerical work undergo a large amount of conversion to A.D.P., in the great majority of organisations in

this country there are not likely to be any appreciable problems on this account in the foreseeable future.

33. There were also some effects on managerial and supervisory responsibilities, including lines of communication, particularly where large blocks of processing, formerly done by clerks, were transferred to a computer in another part of the office. But here again it was too early for these effects to have had a big impact on the office as a whole. If the computer can be regarded solely as a data processing agency the changes brought about in office organisation may not be large, even in the long run.

## A.D.P. as a New Form of Office Employment

### The general scene

1. Apart from its general impact on the numbers of people employed in office work, the advance of computers has brought new forms of office employment into being to operate the systems and get the best out of their potentialities. This chapter and the following chapter attempt to examine these new forms of employment, the attendant problems of recruitment and training, and the special working conditions to which they are subject; and to assess the effect which these factors may have on the rate at which computers are introduced.

2. The operation of A.D.P. equipment calls for the highest standards of work because mistakes can bring highly expensive machines to a standstill. Those employed in the computer room itself, even in the less skilled occupations, are generally selected from the best in the office. During the survey it was commonly noticed that transfer to these duties was regarded as a matter of prestige. A few employers had in fact graded the duties of operating the computer and its peripheral equipment as equal to clerical work and so at least one firm clerks from the general office were used as computer operators on a rota system, not only because of the accuracy needed in the computer room but also to stress the accuracy needed outside it. Although the introduction of computers might at first give an impression of increasing the routine content of office work, in fact it brings greater responsibility because of the importance of making the right decision at the right time, and it provides the clerks associated with the computer with less routine work and a greater need for initiative.

3. The preparation of work for a computer requires very broadly (1) the examination of what the job is, and the drawing up of a plan of how the computer is to do it; and (2) the development of this plan in detail to suit the particular computer, including its

translation into a form in which it can be used by the machine. The first part of this work may be regarded as systems analysis and the second as programming. In practice the dividing line between the responsibilities of the systems analyst and the programmer vary. In some installations no distinction is made, and all the staff are called 'programmers.' Nevertheless, since the nature of the work is similar in all installations, it is assumed for the purpose of this report that the person who does the first part of the work is a 'systems analyst' and the person who does the second is a 'programmer.' Sometimes a separate occupation of 'project planner' is specified. Because of differences in practice on this point 'planners' have been classified in this survey with systems analysts.

### A.D.P. occupations: programmers

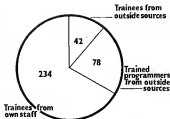
4. *Qualities needed.* Programming is a new occupation. Apart from intensive training it calls for certain aptitudes, such as an ability to analyse a job and set it out logically, a clear head, good memory and patience. The importance of these qualities is confirmed by a widespread acceptance of the need for aptitude tests in the selection of programmers. Suitable tests are usually given by computer manufacturers as part of their service to customers and, in the case of government installations, by the Civil Service Commission. The tests are followed by careful selection by interview.

5. In addition, about a fifth of the organisations co-operating in the survey said they preferred programmers to have certain minimum educational qualifications. There was, however, no unanimity on what these qualifications should be. The views expressed ranged through G.C.E. 'O' levels, 'A' levels, professional qualifications and university degrees. Generally the criterion was a G.C.E. pass at 'A' level, sometimes with a preference

towards mathematics as the subject. Those who made no comment (i.e. four-fifths of the organisations) apparently had no hard and fast rules on this point. Programming was often said to be 'a young person's job' but those who defined this phrase (about 13 per cent. of all these organisations) suggested upper age limits ranging from 25 to 40 years.

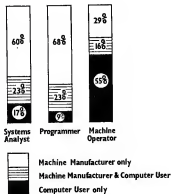
6. *Recruitment.* The sources from which programmers were recruited varied according to whether or not trained personnel were required. Seventy-eight installations reported that they had engaged trained programmers and 246 that they had recruited trainees. A number had some of each. There was a great shortage of trained programmers and most employers did not seek them, except when the need was so urgent that there was not enough time to select and train their own. Some said they had attracted trained programmers from other firms by offering them high salaries, but this they found had repercussions on the salary scales of their other programmers and of other staff in the company. What was essential was to foresee the need for programmers and to get enough trainees well in advance. Two hundred and thirty-four installations had recruited trainees from their own staff and 42 from elsewhere. Some had used both sources. Where further detail was given (by about a half of these installations), it was found that most of those recruited internally had come from accounts work, office machine departments and general clerical duties which, in about a third of all these cases, were among the jobs being affected by A.D.P. External recruitment of trainees was done largely by such media as press advertising and the Ministry of Labour. Some were recruited from school leavers and graduates. For trained programmers press advertising and the Ministry of Labour's Professional and Executive Register were used. The main sources of recruitment of programmers and the number of A.D.P. installations who reported using them are shown in Figure 16.

7. *Training.* The training of programmers was mostly undertaken by machine manufacturers, although 24 installations reported that they had trained all their programmers themselves and 59 had used both these methods. The training within installations was used mostly for replacements or additions to an existing team, where there was a group of experienced programmers to pass on their knowledge. The opportunity for this kind of training will obviously increase in future, although there is little doubt that the need for some formal course of instruction will remain. In addition to this training, practice on the job is needed for several months before real proficiency develops. The sources of training of programmers and other A.D.P. staff are



Numbers of Installations who reported Recruitment of Programmers from above sources

Figure 16.



Percentages of Installations who reported using above Training Methods.

Figure 17

illustrated in Figure 17, with supporting statistical data in Appendix 12.

8. *Future requirements.* One of the factors in any assessment of future needs for programmers is the possibility that programming may become easier. This is usually taken to depend largely on the future development of automatic programming languages designed to make programming easier to learn and quicker to do by transferring some of the programmer's job to the computer itself. Much work is at present being done by machine manufacturers to try to perfect these techniques and make them widely acceptable. At present programmes written by the more advanced, and therefore, potentially, the most valuable of these methods generally take longer to run on the computer and need more storage space inside the machine than programmes written by older methods. This arises largely from attempting to make the new programming languages readily understood and adaptable for a large number of different jobs. Furthermore, most jobs processed by A.D.P. are of a fairly permanent nature; while they change frequently in detail, they remain largely unaltered in their framework. Computer programmes written for these jobs tend to be used over and over again. For example, the payroll programmes will probably be used each week and each month and the programmes for processing the records of goods in stock may be used every day. It is generally accepted, therefore, as worthwhile to make such programmes as efficient as possible in terms of computer usage, and this at present discourages the use of automatic languages. There was practically no mention in the replies to the survey questionnaire of help from these autocodes, although this was one of the subjects on which comment was suggested. There is no doubt that programming languages will be developed into a very valuable aid, but it is possible that they will not make a great impact on office work until the cost of computers has become so much less that the under-utilisation of these machines is of far lower importance than it is at present. In any case,

it is considered unlikely that automatic programming will have any big effect on manpower requirements in A.D.P. within the next three to five years at least—either in the numbers of programmers needed, or in their qualifications.

9. The outlook for programming generally is that as A.D.P. increases, trained programmers will continue to be scarce and new undertakings will probably be staffed almost entirely with trainees. It can be assumed that organisations will continue to search for suitable candidates among their own staff, but although there are no signs of any widespread exhaustion of this source, smaller firms may find it increasingly necessary to look outside their own resources. It is probable that as time goes on more use will need to be made of school leavers. A broad assessment of the minimum numbers of programmers likely to be needed in Great Britain by 1970 and 1974 is shown in Table 7. This is based on the estimates of future computer installations shown in the conclusions to this report, and does not take account of any technical improvements in automatic programming. The table includes the estimated needs for planning, development and utilisation of computers in Great Britain at the given dates and is derived from the estimates of future installations shown in the conclusions of this report.

#### Other A.D.P. occupations

10. *Data processing manager.* The data processing manager is primarily concerned with organising the work, seeing that it is properly done, and maintaining liaison with other departments concerned in the undertaking. In essence it resembles many executive jobs and the main qualities required are the same. Some special aptitude for A.D.P. is also necessary, but this is not so vital as for programming, nor need the age limits be so discriminating. At some 85 per cent. of A.D.P. installations co-operating in the survey the post of data processing manager was filled from the organisation's own staff, often by the person already in charge of the

Table 7—Estimated future minimum needs for staff in main A.D.P. occupations

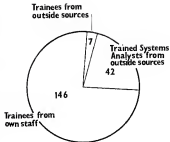
Date	Data Processing managers	Systems analysts	Programmers	Total
January, 1964 (from Table 3) ..	915	2,320	3,540	6,775
January, 1970 .. .. .	4,000	11,500	20,500	36,000
January, 1974 .. .. .	8,000	22,000	41,000	71,000

(Excluding service bureaux and machine manufacturers' services to customers.)

work scheduled for transfer to the computer. This was partly because experienced data processing managers were scarce and partly because of the advantage of having a manager with a close knowledge of the work to be processed. Training usually takes the form of a programming course, mainly to provide background, but skill needs to be developed through experience on the job.

11. *Systems analysts.* Systems analysis is not a new occupation, but in A.D.P. it calls for aptitudes similar to those needed for programmers, frequent use being made of the same aptitude tests in the selection of systems analysts. Only about 15 per cent. of the organisations in this survey called for particular educational qualifications for this work, mainly university degrees, professional qualifications or G.C.E. 'A' levels. But, as with programmers, most employers have no firm rules on this point, possibly because two-thirds of them recruit from their own staff. The numbers of installations who reported that they had recruited trained and untrained systems analysts were 42 and 149 respectively. Some of these installations had obtained both. Those who specified the source of recruitment for trainees mentioned O. and M. departments mainly, followed by accounts and office machine departments. It can be assumed that many of those drawn from O. and M. departments did in fact have experience in the basic techniques of systems analysis but needed further training in A.D.P. External recruitment was conducted mainly through such means as newspaper advertising and the Ministry of Labour's Professional and Executive Register. Training in computer programming and advice in A.D.P. techniques were largely obtained from machine manufacturers, but training courses specifically in systems analysis were few and far between. Some respondents said it would be an advantage if more courses of this type were provided. The sources of recruitment and training of systems analysts are illustrated in Figures 17 and 18, with supporting statistics in Appendix 12.

12. *Machine operators.* Most machine operators are employed on preparing data for the computer, usually by punching and verifying cards or paper tape. Others operate the computer and ancillary equipment under written directions provided by the programmers. The qualifications for machine operators on data preparation equipment are similar to those needed in traditional punched card installations, but some employers would lay even greater stress on the importance of a calm temperament and ability to concentrate for these duties. Computer operators are usually selected from the best machine operators, often with some minimum educational qualification, such as G.C.E. passes at 'O' level. They must also be physically fit, since



**Numbers of Installations who reported Recruitment of Systems Analysts from above sources.**

**Figure 18.**

they are required to be much on their feet and on the move, and they are liable to be called upon for shift work. Male operators are generally used for night work and often for other abnormal hours.

13. *Future needs.* The future needs for data processing managers, systems analysts and computer operators are directly related to the extent to which the use of A.D.P. is likely to increase, a subject examined in the conclusions of this report. A broad estimate of the minimum numbers of data processing managers and systems analysts likely to be needed in Great Britain in 1970 and 1974 is shown in Table 7. The demand for machine operators for preparing data for the computer (i.e. punchers and verifiers of cards and paper tape) is closely linked with the possibility of using automatic translation of data to machine language, for example by machines able to read marked or written documents. Although much progress is being made in the technical development of these methods it is likely to be many years before the bulk of the data received in an organisation—particularly data prepared outside its own control—can be read into the A.D.P. system automatically. This is, however, an innovation which could ultimately have a distinct impact on the comparatively large number of machine operators employed on punching cards or paper tape, and its progress will need to be followed with careful regard to the future of the people so employed.

#### Careers prospects of A.D.P. staff

14. In occupations such as programming, careful selection of staff, expensive training, and much experience on the job are needed to produce experts. It is therefore of some interest to examine how far these employees become specialists and remain in the A.D.P. field permanently; and what their career prospects are.

15. Of the 236 organisations who gave information bearing on these questions about 84 per cent. said that their A.D.P. staff (by whom they generally meant programmers and systems analysts) were eligible for transfer and promotion to jobs outside A.D.P. in their own organisations. In this, practically no distinction was made between A.D.P. staff selected from their own staff and those recruited from outside. Only a very small number of the organisations (less than 1 per cent.) had any definite rota scheme to withdraw staff automatically from A.D.P. after a set period.

16. There was some conflict of opinion about whether experience in A.D.P. enhanced or hindered an employee's career prospects in the organisation generally. Some organisations felt that programmers and systems analysts were exceptionally efficient members of the staff and that their examination of the organisation's work for application of A.D.P. gave them an insight of great value to them beyond the A.D.P. area. Others felt that specialisation in A.D.P. narrowed their field and that their usefulness elsewhere was impaired. It is likely that the nature of the organisation's business and of the work processed by A.D.P. have much to do with the individual outlook. In some organisations occupations outside A.D.P. at an equivalent or higher level than programming called for professional qualifications not usually held by their programmers and systems analysts—such as in accountancy. In these cases extra study would need to be undertaken to provide inter-changeability and some of the organisations concerned were encouraging their A.D.P. staff to do this.

17. During the current survey employees themselves were not generally asked about their attitudes to an A.D.P. career, but it was thought among management that there was a general reluctance among programmers and systems analysts to leave A.D.P. and many hoped to find a career within the field, not only for financial reasons but also because they had developed a particular interest in the work. Some of the larger organisations were devising a career structure for A.D.P. within the firm, with a progression to cover such grades as trainee programmer, programmer, senior programmer, systems analyst and data processing manager. In the majority of firms, however, the scope for this was very small and most A.D.P. staff who wished to

find better jobs in this field would have to look elsewhere.

18. In general the prospects of a good career structure within A.D.P. as a whole seem to depend on the following factors:

(1) The ratio of the numbers of jobs in the main occupations. On 1st January, 1964, these were roughly, data processing manager—1; systems analysts—3; programmers—6; excluding service bureaux and machine manufacturers' staff. If both the latter were included the ratios became 1:3½:5 respectively;

(2) Most of those at present in these occupations are young and in much the same age group. This acts against a steady progression through retirements;

(3) Some staff come into A.D.P. at the higher levels, because, for example, their past experience with a company is in itself a valuable asset to systems analysis. This reduces the opportunities of those who enter below;

(4) Programming abilities may decline around middle age because some of the attributes needed, such as a good memory, may tend to fade; those who are still in programming at this time of life may become badly frustrated in their work;

(5) Because most firms have made A.D.P. occupations interchangeable with others there will be a considerable flow of staff away from A.D.P. occupations;

(6) But the most important factor for the near future is the general expansion in A.D.P. which will open up many new opportunities in this field.

19. Since most organisations have recruited the great majority of programmers and systems analysts from among their own staff they prefer on the whole to keep them, because of their experience of the business and the mutual confidence which this engenders. Interchangeability of staff between A.D.P. and other parts of the organisation is well suited to this concept. If A.D.P. expands rapidly and many more firms are forced to search for programmers, trained or trainee, outside their own resources, they may be less inclined to allow them the prospect of transfer to other work in their organisations, not only because the old loyalties will have been broken down, but because the difficulties of obtaining programmers will have increased, and the consequent rise in their salaries will have put them out of step with their counterparts in other branches of the organisation. This could in the long run force A.D.P. staff to become a specialist class with careers confined to A.D.P. This situation is unlikely to arise for a number of years because the scale of probable expansion of A.D.P. will not

be sufficiently great. In the long term, it may be circumvented by recruiting potential programmers more and more from school leavers and making sure that they get adequate training at an early stage.



## Working Conditions in A.D.P.

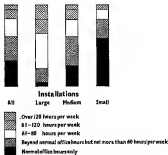
1. The conditions in which A.D.P. is operated also have a bearing on the problems of recruiting, and keeping, staff for this new and expanding form of employment, and might therefore have an influence on the rate of expansion.

### Hours of operation of A.D.P. equipment

2. Ancillary equipment such as card punches is mostly operated only in normal office hours. The period of operation of the computer (for which a relatively small team of operators is needed) ranges from a few hours a week, inside normal office hours, to day and night, seven days a week. Many of the organisations commented on this subject. Of these, 34 per cent. were operating within normal office hours, 31 per cent. in excess of this but not more than 60 hours a week, 20 per cent. from 60 to 80 hours a week, 11 per cent. from 81 to 120 hours a week and 4 per cent. more than 120 hours a week. This is illustrated in Figure 19 and a statistical analysis is in Appendix 13. These percentages were derived from a large number of installations (259), which were in various stages of development, ranging from those for which computers had only just been ordered to installations which had been operating for many years. The majority of organisations gave the ultimate hours they intended to operate or else made it clear that their current usage would not be altered. Wherever different figures were quoted for the present and the future, the latter were used in the analysis. Thus the position shown tends on the whole to be representative of the position for some years ahead.

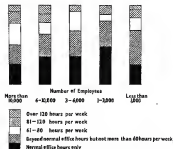
3. Computer usage was analysed by size of installation and size of organisation. The results are shown in Figures 19 and 20, with statistical analysis in Appendix 14. For any given size of organisation there is a strong relationship between hours worked and the size of installation, and there is also a somewhat weaker relationship between hours worked and size of firm for that range of installations for which

enough data is available (i.e. the medium-sized installations). The large computer installations are mostly in large organisations and these users tend on average to operate their equipment for longer hours than others. More than three-quarters of the large computers were in organisations which employed more than 10,000 people, and about 70 per cent. of these were subject to operating hours in excess of 60 a week. The operating hours of medium-sized computers, which are the majority, were broadly, one-third within normal office hours, one-third between normal office hours and 60 hours a week, and one-third in excess of 60 hours a week. The operating hours of the great majority of the small computers were less than 60 hours a week.



Average weekly usage of Computers

Figure 19.



Usage of Computers by size of Organisation

Figure 20.

4. A comparison between the hours now used by a representative group of fully established installations and the ultimate usage planned by a group which were still developing, indicated that there is likely to be an increase in the hours for which computers are used in the next few years. The nature of the sample does not permit precision, but the contemplated increase in hours is around 20 per cent. and the resultant average usage between 60 and 70 hours a week. Whether there will be any further marked change in the intentions of computer users towards hours of usage will depend to some extent on the cost of A.D.P. equipment. Any decrease in equipment cost will tend to make its use for long hours less worthwhile. On the other hand any trend towards bigger A.D.P. installations, particularly large centralised systems using few operating staff, will encourage the maximum use of machines. There are other factors, however, and it became clear during the survey that many users do not calculate the hours of computer use on an economic basis, but are influenced more by less quantifiable factors, such as a disinclination to interfere with traditional office practices, apprehension about staff resistance to abnormal hours, and a policy of "wait and see." It was also clear that the transition to long hours outside normal office working had sometimes been forced upon users by sheer pressure of work for computer processing. Although this was probably the result, in part, of under-estimates in the original time schedules, a substantial contributory cause was said to be the fact that additional uses had been found for the computer after the original plans were made. In the long run it is

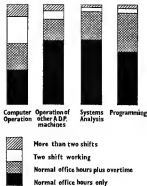
likely that economic criteria will prevail and that the hours of usage at individual installations will become more related to their capital cost.

#### Hours worked by A.D.P. staff

5. The manner in which hours of work are arranged to cover A.D.P. operation can take many forms, including normal office hours, overtime, shift working—in which shifts of different workers may or may not overlap—evening duty, night work and attendance at week-ends. Once the A.D.P. system has been set up the broad pattern of computer time is fixed by the work which has been transferred to it and within this framework the user has to plan his staff's working hours, including both the total number of hours which each employee works and their incidence. Most replies to the survey gave information about the hours expected to be worked by A.D.P. staff when installations were fully established. About 88 per cent. provided details of computer operators' hours and some 75 per cent. also commented on other categories of A.D.P. staff. The main points from the replies are illustrated in Figure 21, which sets out the position broadly on an occupational basis. The supporting statistical analysis is in Appendix 15.

6. *Hours of work.* As a general appreciation, computer operators were employed in about 35 per cent. of A.D.P. installations during normal office hours only; in 26 per cent. on normal hours plus some overtime; and in 40 per cent. on shift work, with 12 per cent. on more than two shifts. For each of the other main A.D.P. occupations between 50 and 70 per cent. of installations were keeping within normal office hours; about 20 to 40 per cent. were using overtime; and only about 10 per cent. were resorting to shift work. From the information given it appeared that each shift averaged about 12 employees. Abnormal hours were paid for in a number of ways including bonus payments, overtime rates, time off in lieu or salary scales above the average.

7. *Incidence of work.* Less than 30 installations had night work and only one or two employed staff solely for this purpose. For the most part the night shift was covered by male staff on a rota. Practically all the other installations were operated only during the day time, although about a quarter were working long hours from early morning to late in the evening, with two overlapping shifts of staff. In one or two installations long periods of day-time operation were being largely covered by operators on a four-day week, working long hours on Monday to Thursday and taking the following three days off. Programmers, who were subject to appreciable overtime, occasionally had to work at unusual hours, such as late in the evenings or at week-ends, particularly for testing programmes on the computer.



Arrangement of hours of work in main A.D.P. occupations.

Figure 21

Some 35 organisations had adopted week-end working for normal processing.

8. *The future pattern.* Although employees were not generally consulted in the course of the survey about working conditions, management were asked to comment on any difficulties that had arisen from such factors as abnormal hours of employment, noise and heat from machines, the discipline of A.D.P. procedures, monotony and fatigue. They had encountered little trouble. Indeed, in some cases it appeared that the 'cool, pleasant atmosphere' in the computer room was an attraction to the staff employed there. On the other hand, a small number of employers had experienced some difficulty in arranging meals and transport for shift workers, mainly where night shifts for a few staff had to be operated, in which circumstances the practice generally was to employ only men. It was also evident that although the noise of the machines was not cited as a real difficulty a great deal of sound-proofing had had to be done.

9. Nevertheless, quite apart from the natural tendency towards trying to make sure that expensive machines 'pay their way,' there is a fundamental difficulty in fitting computer operation into convenient office hours. Under clerical systems, a small increase in work may be handled by taking on one or two extra clerks, but usually it is impracticable

or uneconomic to buy a little more computer capacity for such contingencies. A more probable solution would be to break into another shift on the existing machine. There is also need for considerable flexibility in hours of work during the development of an A.D.P. system—a phase which, as has been seen, can extend over several years. On the whole it is likely that computer working outside normal hours, on overtime or on shifts will tend to increase over the next few years but that it will, by the nature of the occupation, be restricted to comparatively few people.

#### Help given and received

10. A.D.P. can, when the circumstances allow, lend itself to mutual aid amongst users or to assistance from manufacturers or bureaux both during the difficult period while A.D.P. is being installed and during emergencies or periods of peak activity. Such assistance might on occasion amount to the equivalent, in manpower terms, of lending more than a hundred clerks, which in some respects represents a new form of manpower mobility. Almost all the respondents to this survey had received help from machine manufacturers, mostly for planning and programming, including systems analysis. For those who gave details the amount of help received per installation amounted on the average to more than one man-year for programming and nearly two man-years for planning. Machine manufacturers also provided help in testing programmes and proving systems before the delivery of the customer's own machine and in training computer personnel. Some 10 per cent. of computer installations used service bureaux to prepare data for the initial running of the computer, including the conversion of large files. About 7 per cent. made use of professional consultants, mainly in the early planning stages of the project. About 10 per cent. of computer users were employing spare capacity in their machines on work for other organisations, much of it among subsidiaries within a business group, and about 10 per cent. reported that they had an arrangement with another computer user with similar equipment for mutual cover in the event of serious machine breakdown. A few organisations had collaborated and set up joint A.D.P. installations, each sharing the cost and the processing facilities.

11. On the whole, however, mutual help amongst users has not so far been very extensive, partly because of the incompatibility of the different types of equipment used. Even machines of the same type may have differences in speed, internal capacity or peripheral equipment which make them unsuitable for doing the work of other machines of the type. This means that there will be no great increase in mutual assistance between computers in the next five

years. The longer-term future depends on how much standardisation of equipment is found practicable or desirable and upon the development of high-speed data transmission channels which could also have a pronounced influence on the interchange of data processing facilities. There is also unlikely to be much change in the amount of help needed from machine manufacturers, even as experience in the use of A.D.P. builds up. The machine manufacturer with experience of many customers becomes the natural repository of ideas for the use of his particular equipment, and he also compiles and maintains a library of programmes, including some which are essential to the day-to-day operation of the machine.

#### Location of work

12. The future distribution of manpower in offices will be influenced by the extent to which all the work of an A.D.P. installation can be centred in one place or how far some parts of it, such as the preparation of data in machine form or action on the results of processing, can be done elsewhere. The output from computers is frequently used at some distance from the machine installation, particularly where it has been condensed to statements which can be transmitted easily (such as information for management). Payroll work, in particular, is usually centralised for A.D.P., and details of pay are often sent to outstations for payment. But for most applications the bulk of the computer output is at present dealt with on the spot. Preparation of data for A.D.P., which mainly requires the punching and verifying of cards or paper tape, is mostly done at the computer installation, though nearly 20 per cent. of the organisations participating in the enquiry did some of it at another place. Relatively few of these concerns said how they transmitted the data to the computer, but of those that did about half used machine transmission over telex or telephone circuits, and most of the others sent cards or tape by road, rail or post. A further 20 per cent. of the respondents had moved some work to another place for A.D.P., and while the shift was not towards any particular part of the country, there was on the whole a trend towards more centralisation. Some of the organisations said they hoped eventually to de-centralise again when data transmission systems improved.

13. Data transmission systems (by which in this context is meant the passing of data automatically over such links as telex, telephone circuits or radio) are also connected with the question of preparing data away from the computer. So far they have not been used widely in the field of A.D.P., because the majority of computer users prefer to prepare data at the computer centre or have no reason to do otherwise. Nevertheless, some banks are developing

decentralised data preparation by preparing punched paper tape at branches for transmission over telephone lines, and by encoding information in magnetic characters on cheques. Some retail and wholesale distributors are preparing punched paper tape automatically in their cash registers or pecking a previously punched card in cartons of goods so that when the contents are sold, the card can be returned to the A.D.P. centre as a means of passing the information into the computer automatically. And at least one bus company is developing a system based on a conductor's ticket machine which will automatically record details of sales on a magnetic tape suitable for reading directly into A.D.P. equipment.

14. Most of these systems record data in a machine language near the point of origin and thus reduce the amount of human effort needed to translate it into a form which the computer can accept. A similar effect arises from the use of document readers which can distinguish significant marks on paper or, under certain conditions, read typed numbers. Although the quantity of these machines at present in service is small, they obviously have great potential, especially as they become more versatile. Moreover, the development of higher-speed data transmission systems may eventually lead to more direct communication between separate machine installations and reduce the need for intermediate conversion of data. All these factors can affect the number of machine operators needed for data preparation, of whom there were in 1964 some 11,000—nearly half of all A.D.P. staff.

15. It is unlikely that these developments will have any great impact on data preparation staff in the next five years, especially since the rising number of computers in use will require more machine operators, and in some places make the finding of enough recruits very difficult. In the longer term, these developments may well have much greater significance. For the present the technological possibilities are great but the manner in which they will be used is obscure.

## Summary and Conclusions

1. This report has been about the manpower effects of A.D.P. in offices. Its purpose has been to see what happens to staff whose work is transferred to A.D.P. and to examine the longer-term effect of A.D.P. on office employment as a whole, in numbers, organisation and quality of staff.

2. These questions have to be set against the background of the rising demand for office staff. Between 1953 and 1963 the working population of this country increased by 0.7 per cent. per annum, but over the same period the proportion of office workers in the labour force also rose and the growth in office manpower was about 3 per cent. per annum. During the next decade the working population is expected to rise much less, and as the Manpower Research Unit's first report (Manpower Studies No. 1) observed 'in the past years the increase in the working population has contributed substantially to the overall growth of the economy. Over the next decade at least the same rate of economic growth will be needed in order to keep pace with the increase in the total population. By contrast our manpower resources are expected to grow much more slowly than in recent years. Clearly, therefore, productivity (output per occupied person) will need to grow at a faster rate if the present rate of improvement in living standards is to be maintained, let alone speeded up.' This is particularly true of office work where the labour force grew in the past decade several times faster than the general average.

3. This situation has a bearing on certain further questions relating to the future. Is the manpower factor likely to retard or accelerate the advance of A.D.P. in office work? Will A.D.P. on the one hand meet, or help to meet, the growing demand for staff; or will it, at the other extreme, create large-scale redundancy in office employment? Or will it run into other difficulties in which the supply of certain types of office manpower is the chief element?

### What is happening at present

4. *Effects on staff.* First, as to the present. The effect of A.D.P. on the office has varied according

to what methods were used formerly. Many organisations had been using punched card systems and the main impact of mechanisation had been absorbed many years ago. The transition to the computer has been a smooth and, as some respondents in this survey said, a natural step in the evolution of office machinery. Others, where only clerical procedures had been used previously, found a much greater change in their office work. Most organisations, however, had used a mixture of methods; close on a half had installed a computer to replace a combination of clerical, keyboard accounting machine and punched card methods.

5. The effect on office staff has been reduced by three important factors. Firstly, it takes at present on the average about five years to install an A.D.P. system, from the first serious examination of the possibilities to full completion of the changeover. This provides ample time for planned reorganisation, and for normal wastage, for example through retirement, to operate on any reduction of staff. Secondly, the number of office workers in the areas so far affected by computers has been relatively very small—only some 20 per cent. of the office workers in the organisations with computer projects, less than 6 per cent. of all employees in these organisations and about 0.8 per cent. of the total working population. Thirdly, a high proportion of office workers are women who come into employment and leave it with considerable fluidity. For example, in 1961 about 33 per cent. of female clerks in Great Britain were in the age group 15-24 and unmarried. The distribution into age groups from 15 to 54 years was broadly in this ratio:

Age group	15-24	25-34	35-44	45-54
Single .. ..	7½	1	1	1
Married .. ..	2	2½	3	2

(Where each unit = roughly 50,000 persons.)

This suggests that many were leaving office employment at that time between the ages of 15 and 24.

6. *Employees discharged.* It was found that in fact very few organisations had had to discharge staff because of the introduction of A.D.P. Only 13 such instances came to light and in these the actual numbers stated to be discharged averaged less than 10 in each case. Six of the 13 organisations had moved some of their work to another place for A.D.P.

7. *Other effects.* For all that, there were of course repercussions on staff and action had to be taken to clear redundancies. The most frequent method was through normal wastage, assisted often by reducing the recruitment of permanent staff and increasing temporary engagements before the computer arrived. There were also transfers to other jobs, both within the A.D.P. area and elsewhere. The situation was generally made easier by the large proportion of women in the office and by a rising volume of business. Most of the staff in the area affected by the computer experienced only minor changes in the work they were doing.

8. It was of course more difficult to avoid disrupting staff where work was moved to another place for A.D.P. About one in five of the respondents to the survey did this, although most moved only part of the office and many staff were found new jobs at the same place. In the minority of cases where a major shift was made in the location of the office, a nucleus of key staff was usually transferred to the new processing centre, often with help from the employers in matters such as time off for house-hunting, arrangements for schooling, expenses and loans for house purchase. Generally, staff on machine operation and clerks on routine work, although offered a move to the new area, chose not to go, largely because they were women with local ties; often, when the time came to move the work elsewhere, it had been arranged that many of the female staff, appointed during the period when the computer plans were known, were on temporary engagements only.

9. *The general picture.* On the whole during the changeover to A.D.P. the total number of office workers employed by organisations was rising. There was some reduction in female staff in the part of the office affected by the computer, but a rising volume of business more than offset this in other sections. Among most of the organisations who were sufficiently advanced in A.D.P. to give reliable figures, the reduction in the A.D.P. area was about 10 per cent mainly among the female staff, while the increase in the rest of the office, which was some four times bigger than the A.D.P. area, was about 12 per cent., mostly women employees. Most employers who knew that they would be faced with redundancy problems took positive action in advance to meet them. Many found that the redundancy was

small and spread over a long period and could therefore be cleared automatically by normal wastage. Others found that A.D.P. merely reduced an existing staff shortage.

10. *Effect on jobs.* Although staff have not been greatly disturbed by the introduction of computers, it is necessary to consider the effect on jobs as a separate issue, because A.D.P. systems have not only taken over a number of jobs which existed before they were installed, but have also absorbed work which arose subsequently and which would, in other circumstances, have created new jobs for staff. One way to gauge the effect on jobs is to take the situation as it is with A.D.P. and compare it with what it would be without A.D.P. Obviously no more than a very broad estimate can be attempted because during the long time taken to install A.D.P. the work required of the office will have altered and there are also likely to be jobs which could not have been done, or would not have been created without the computer. With these reservations, it is estimated that the number of jobs taken over by computers, or expected to be taken over, averages 108 per A.D.P. organisation. The number of these posts which had accrued by 1st January, 1964, when many installations were in a transitional stage, amounted to between 2 and 3 per cent. of all office jobs at these organisations. About two-thirds of jobs taken over were clerical. To off-set this in part, a large number of jobs had been created by A.D.P., including data processing managers, systems analysts, programmers and machine operators. In all, these average about 18 posts per A.D.P. organisation, and amounted to about 0.7 per cent. of office jobs at all these organisations by 1st January, 1964. It is clear that A.D.P. has reduced the number of jobs which would otherwise have been available, but, while for the reasons shown it is not possible, even in an individual organisation, to be explicit, the net reduction is small and can be estimated very broadly at around  $\frac{1}{2}$  per cent. of the total number of office workers in Great Britain.

11. *Occupations in A.D.P.* New office occupations have been created by A.D.P. Of these the most specialised and significant are systems analysts, programmers, and data processing managers. The systems analyst analyses the job which the computer is required to do and draws up the system for its performance in broad terms. Most organisations recruit their systems analysts, generally after selection by aptitude tests, as trainees from their own staff. Training is generally given by the computer manufacturer, mainly in the form of a programming course, but skill comes only after considerable experience on the job. The work requires both a good knowledge of A.D.P. techniques and a sound understanding of the employer's business. Good systems analysts are hard to get.

12. The programmer converts the systems analyst's broad plan into the detailed instructions for the computer. Special aptitudes, which are to be found more in youth than in later life, are needed. Training is generally given by the computer manufacturer, but several months' practice on the job may be required before the trainee becomes fully effective. On 1st January, 1964, there were about 3,000 programmers on office work in Great Britain, of whom about 2,500 were men. In addition there were about 1,200 programmers at service bureaux and on manufacturers' services to customers. Trained programmers are already very scarce, even at the present rate of expansion of A.D.P. and most organisations recruit them as trainees, primarily from their own staff.

13. The data processing manager, who takes charge of the A.D.P. project, is generally appointed from the organisation's own staff; many data processing managers have great aptitude for A.D.P. but the important attribute is management ability to see the difficult change-over to A.D.P. through smoothly and on time.

14. The machine operator's job in A.D.P. includes preparing data for the computer on punched cards and paper tape. A small number operate other machines, particularly the computer and ancillary machinery. Accuracy and physical fitness are important in this work and those selected for computer operation are often amongst the best in their grade in the office. Over 90 per cent. of machine operators are women but because of the tendency towards greater use of computers on shift-work the proportion of male operators in the computer room, at present averaging about one in four, will probably rise.

15. *Career prospects under A.D.P. systems.* At present most employers regard their systems analysts and programmers as eligible for transfer to other work within the organisation, although there is no doubt that these are specialised forms of employment which exercise a strong hold on those engaged in them. The existing ratio in the numbers of data processing managers, systems analysts and programmers is 1:3:6 (excluding service bureaux and manufacturers' services to customers) and for some time to come career prospects are likely to be good while A.D.P. continues to expand. In the longer term, specialisation in A.D.P. jobs may increase and if programming continues to be 'a young man's job' some difficulties may develop as programmers reach middle age.

16. *Staff structure under A.D.P.* Under A.D.P. the proportions of staff at the machine operation, clerical and executive levels are changing and the question arises whether any increase in machine operators and executives (including systems analysts,

programmers), combined with a reduction in clerks will create a restriction in the middle grade and so affect promotion. Up to the present these effects have not been important because they have been very small in relation to the numbers of office workers as a whole. Also the numbers of machine operators have increased in only some offices, mainly because of a substantial decrease in numbers of keyboard accounting and addressing machines. It is probable, however, that as A.D.P. builds up there will be a general increase in office machine operators, at least as long as data is prepared in large quantities by punching cards or paper tape. Nevertheless, the effects are likely to be limited partly because the status of machine operators is rising with the installation of A.D.P., particularly in the computer room, and partly because the turnover rate among machine operators is very high, with comparatively few of them seeking permanent employment in the office. Isolated difficulties might occur where large blocks of routine clerical work undergo substantial conversion to A.D.P., but in most organisations in this country problems arising from changes in staff structure are not likely to have any appreciable impact for many years to come.

17. *Working conditions under A.D.P.* There appears to be little in the physical conditions—factors such as heat and noise—under which A.D.P. operates that need act as a deterrent to its acceptance by staff. But computers are capable of making special demands in terms of hours of work. Some of the very large ones are now operating day and night, seven days a week; most of the small ones are used only for normal office hours. Although in theory much rests on striking a reasonable relationship between the cost of the computer and the additional expense of running it outside normal office hours, in practice less precise factors, such as reluctance to depart from traditional hours, the wishes of staff, and the difficulty of arranging meals and transport for shift workers play a larger part in the issue. In these circumstances departures from normal working are forced on some users by the stresses of rising volumes of work for computer processing. Thus there are indications that between a half and a third of A.D.P. users are employing or expect to employ their operators in shifts, often with spells of duty overlapping; for example, a long day's processing might be covered by the first team working from 7 a.m. to 3 p.m. and the second from 1 p.m. to 9 p.m. Those users who are at present processing at week-ends or during the night are still a small minority. But if the need to work abnormal hours increases, the staff required for the operation of a computer and its peripheral equipment would be comparatively few, ranging from one or two to about a dozen, depending on the size of installation. Other machine operators in A.D.P. installations,

mainly those employed on punching cards or paper tape, are for the most part expected to work only normal office hours. The same is true of systems analysts and programmers, though they may be liable to rather more overtime or to working at odd hours, mainly to test computer programmes. In sum, present trends do not indicate that the need to work abnormal hours will create any insuperable problems.

#### Implications for the future

18. Manpower forecasts in this report are not the result of precise calculations. They are based on the best data available, often in the shape of informed opinion, and on detailed study of this information and of its bearing on what is mostly likely to happen.

19. *The next five years.* As far as the short term is concerned, the dominant factor is likely to be the length of time which it takes to install A.D.P., an aspect which this report has examined in some detail. This period, which now averages about five years, may be cut down a little with growing experience, though there is no evidence for this from current trends, but in large part the A.D.P. pattern for the next five years is already set and the direct manpower effects are likely to be small. On the one hand, over that period, the amount of processing transferred to A.D.P. is expected to increase steadily but not spectacularly. A.D.P. is unlikely to contain the rising demand for office workers, though it will help. On the other hand, A.D.P. is unlikely to produce problems of redundancy in offices, except possibly in isolated cases where business is not expanding or work is moved to a new location and staff displaced by A.D.P. have no ready access to employment in other parts of the organisation. Even there, the situation should be met by recourse to far-sighted management practices, such as those already discussed in this report.

20. One of the main difficulties that could hold up the speed with which A.D.P. can be introduced, in the short term, is the shortage of experienced systems analysts and programmers. Since the formation of a programming team precedes the operation of the computer by a year or so, the demand for these staff over the next few years is likely to be influenced not so much by the number of systems already being developed, as by the orders for equipment yet to be placed. Machine manufacturers report that orders for computers are becoming more numerous and this will lead to a corresponding increase in the need for programmers. This situation will call for foresight on the part of new A.D.P. users to ensure that their needs for systems analysts and programmers are planned accurately and well in advance, since practically all these posts will have to be filled by trainees.

21. Hours of computer usage are likely to rise in the next five years, mostly in the direction of long periods of day-time operation on five-days-a-week. The operational staff concerned will probably tend to be organised in two overlapping shifts, and, because women have little inclination for abnormal hours of work, these shifts are likely to be composed mainly of men. The number involved, however, will be relatively very small, because it is a question only of the operation of computer equipment.

22. *The longer term.* The rate at which A.D.P. will advance in offices is governed by a number of interrelated factors of which the most significant perhaps are these:

(1) The scope for further advance; particularly the number of organisations in which A.D.P. could successfully be exploited and which have not yet entered this field;

(2) Management policy; there are a number of aspects to this, including comprehension and appreciation of the uses to which A.D.P. can be put, and the complex motives which lie behind the decision to invest in A.D.P.

(3) Technical developments in the A.D.P. field, including the possibility of reducing the cost of equipment, and of organising its introduction and operation on simpler lines;

(4) The manpower factor, including on the one hand the possibility of a shortage of office workers, and, on the other, the psychological effect of fears of possible large-scale redundancy.

23. *Scope for further development.* As has been seen, A.D.P. in office employment has been advancing steadily, until by January, 1965, there were over 600 computers in use with about 400 more on order. The questions for the more distant future are what scope is there for further advance, what are the factors making for a greater rate of advance, and what are the manpower effects likely to be? In theory the scope for further application is almost unbounded because, by recourse to service bureaux (for which there are at present over 40 A.D.P. installations) even small businesses can avail themselves of a few hours of computer time when they are needed. But the economic possibilities of this type of usage are not without limit, since the full potential of the computer can often be developed only to the rapid handling of large quantities of data. Attempts have been made by manufacturers and others to estimate the number of organisations in Great Britain who have enough data to process to bring out this potential, and, as an indication of the general order of magnitude, it is reasonable to suppose that no more than 10-15 per cent. of the potential field has so far been penetrated. As



business increases with economic growth and A.D.P. machines improve, this field will, of course, also expand. From present trends in the rate of development it appears unlikely that the limits of computer use will be even approached within the next 10 years.

24. *The attitude of management.* One of the crucial factors that will affect the spread of A.D.P. is the motive that lies behind the decision to invest in this expensive equipment. This report has therefore examined in some detail the uses to which A.D.P. is at present being put and the reasons which led to its installation. What emerges is that in large part the uses are still of a routine rather than forward-looking and productive character and that the reasons come from necessity (the shortages of staff or space or the need to replace outworn equipment) as much as from imaginative appreciation of the more dynamic potentialities of A.D.P.

25. During the present survey comment was offered on a number of occasions on the difficulty of enlisting the whole-hearted and unanimous interest of top management in computers. It was suggested, and the expense and complexity of installation make the suggestion understandable, that the machines and their advocates carry less than complete conviction in some cases to the minds of those who have to make the investment decision. It is also probable that on occasions management feels a need for competent and independent advice in these matters. However, there were signs during the survey that computers are being increasingly accepted by existing users as a normal part of the office—indeed sometimes the very centre of it—and it is reasonable to assume that as computers increasingly establish their worth in particular businesses the effect on the mind of management as a whole will be cumulative and lead to some acceleration in the adoption of A.D.P. as standard office practice, at least of the larger organisations. Nevertheless, the failure of some managers to learn about computers and make an objective evaluation of their usefulness may hold back their full development.

26. *Technical developments and cost.* Apart from the fiscal incentives, which are already considerable, developments in the production of A.D.P. equipment may well lead to organisations getting better facilities for their money, if not to a reduction in the amount spent on equipment. Larger computer stores, faster operating times and quicker access to information—particularly quick random access—may have a marked effect on the range of work to which A.D.P. is applied. Moreover, the availability of cheaper small computers and developments in sharing time of large computers between several concurrent jobs are making A.D.P. an increasingly practical proposition in the smaller firm. During the survey, firms with as few as 100

employees had already installed computers. The choice can (and, as the survey found, actually did) arise between engaging a dozen or so extra staff for a new job, with attendant overheads, including furniture and extra office space, and buying a computer. In some cases the computer can be the better business proposition.

27. This report has already referred to the possibility of new and important machine features with an eye to their potential effects on office manpower. The chief of these features, from this point of view, are automatic character recognition—equipment capable of reading original documents and passing the information straight into A.D.P. equipment—and high speed data transmission to enable data in the language of computers to be passed quickly over long distances. Such devices are not yet fully developed, but they may, if successfully exploited, have a direct effect on manpower, especially on the numbers of machine operators employed. In the longer term computers may be developed which can automatically improve their own programming with use. This, with developments in automatic programming languages, would have a marked effect on the numbers and qualities of programmers required.

28. Some of the new machine developments may have an effect also on the future organisation of A.D.P. This must still be a matter for speculation but the possibilities appear to range from large centralised machine installations based on big computers, linked perhaps with an organisation's branches by high speed data transmission, to many small installations situated in various parts of the organisation. Many variants, such as a large central installation linked with smaller satellite installations, might equally be feasible.

29. The effect of A.D.P. on office employment cannot be fully considered without some reference to automation as a whole. The office is being drawn closer by A.D.P. to the factory. There is some growing similarity in duties as automation transforms some industrial work to the surveillance of instruments and control of switches and transfers some office functions to A.D.P. equipment. Moreover, in some industries A.D.P. systems are becoming involved in both office and factory processing, for example, where the system deals with orders received from customers, works out the most economical way of cutting up manufactured material and uses the data for direct control of the cutting machines. Another aspect is that during this survey a number of A.D.P. users said that they were using office computers to 'run the business better.' In this description some included more economical production in the factory with consequential effects on industrial work. No attempt has been made at

this stage, however, to investigate the influences on industrial employment, since that was outside the scope of a study of the effects of computers on office employment.

#### The manpower aspect: general conclusions

30. The general weight of evidence made available during the survey suggests that A.D.P. will not produce any dramatic changes in office employment, over the next five years. The total effect over the seven years, 1964 to 1970, may well be that A.D.P. will do no more than reduce by about one-fifth the demand for additional office manpower (a reduction of some 150,000 posts if the present rate of expansion continues).

31. Beyond 1970 the picture is more obscure, but from examination of the evidence at present available it is considered that the number of computers installed for A.D.P. will rise to at least 6,000 by January, 1974. This would require an increase in the rate of ordering from about 350 in the year 1965 to 1,000 in the 12 months ending July, 1972, and in the rate of delivery from 215 in 1964 to about 1,000 in 1973. It appears unlikely that this rate of growth will be much exceeded unless there is some incalculable burst of computer activity, such as might arise from government stimulation. A table showing growth up to 1964, with estimates of future expansion to provide 6,000 computers by 1974 is in Appendix 16. It is improbable, however, that the figure of 6,000 will represent the limit of computer development, firstly, because technical progress and the increasing efficiency of these machines is continually raising their potential usefulness, and secondly, because of experience in U.S.A. where the number of general purpose computers in use now amounts to about 20,000 and there appears, even with these large numbers, to be no general slackening off in the rate of installation.

32. The average number of office posts expected to be taken over by computers will tend to be influenced by three factors: firstly, by the increased efficiency of these machines, a feature which will have limited manpower effect, since a rise in machine efficiency would tend to be offset by fewer of them being acquired; secondly, by a tendency for a greater proportion of computer time to be devoted to new methods of assisting management decisions, such as in planning production and regulating stocks, where the effect of the computer lies more in increased profitability than in reducing manpower; and thirdly, by a modest rise in the proportion of smaller installations which, per pound invested, would probably take over less office work than large machines. Nevertheless, in the following forecast of future manpower effects, it has been assumed that the number of office posts taken over per computer will be unchanged and the estimates of

the total number of posts to be taken over in the next 10 years may, therefore, tend to be high.

33. With this proviso the delivery of 6,000 computers by the beginning of 1974 would result in A.D.P. having taken over approximately 300,000 office posts in the preceding 10 years. The number taken over in the year 1973 would be about 54,000. Meanwhile office work is expected to continue to grow. Since 1931 it has been rising at an average rate of nearly 3 per cent. per annum. Even if it is assumed that it will rise in the next decade by an average of only 2 per cent. per annum, the extra office posts created by January, 1974, would amount to over 700,000 posts. The addition during the year of 1973 would be about 78,000. After offsetting the posts expected to be taken over by computers, calculated as above, there would still remain over these years more than 400,000 posts to be filled by additional office staff, including about 24,000 in 1973. To achieve a position where the number of posts taken over by computers during 1973 equalled the number of additional jobs created in that year, would require the delivery by January, 1974, of some 3,500 computers and there would still remain a balance of about 300,000 additional posts for personnel, accumulated over the years 1964 to 1972.

34. The filling of additional office posts is likely to become increasingly difficult. It is expected that, in the 10 years 1964-74, the total population in the United Kingdom will rise by about 8 per cent. but the working population by only about 1½ per cent. This is liable to produce a growing shortage of manpower, the effect of which would be felt acutely in the office, where work might, on past trends, rise in the next 10 years by as much as 30 per cent.

35. Even if the effect of A.D.P. went appreciably beyond the above figures and if, ultimately, it were found capable of making a substantial reduction in the total number of office employees, the pace of introduction of these complicated processes is unlikely to quicken to the extent that redundancy cannot be foreseen in time to allow its absorption without any serious hardship to the general community of office workers. But on the whole it seems evident that the effect of computers on office employment in the next 10 years will be to offer some relief to a growing shortage of office workers. For some firms the use of computers may be an essential means to survival.

## Acknowledgements

The co-operation given to the Unit by many organisations has been warm, enthusiastic and generous, and is much appreciated.

Reference was also made during the survey to the following publications:

Electronic Computers in Australia. Employment and Personnel Aspects.  
*Department of Labour and National Service, Australia. September, 1962 and December, 1963.*

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*United Kingdom Automation Council.*

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*Parts I-V. Association of Certified and Corporate Accountants, 1959-64.*

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*R. B. Thomas. Staffordshire College of Commerce. July, 1964.*

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*United Trade Press Ltd., London.*

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*Hertfordshire County Council Technical Information Service. September, 1963.*

## Office Workers in Great Britain

(Page 3)

Thousands

Year	All Workers			Office Workers		
	Males	Females	Total	Males	Females	Total
1921	11,612	5,193	16,805	683	532	1,215
1931	12,634	5,708	18,342	728	614	1,342
1951	14,749	6,808	21,557	921	1,392	2,313
1961	15,432	7,578	23,010	1,083	1,939	3,022

Source—Censuses of Population.

Above figures do not include persons out of work or members of H.M. Forces.

Office workers include clerks, secretaries, typists, office machine operators.

A small amount of estimation is embodied in the above figures because of differences in classification for the individual censuses.

## Proportion of Administrative, Technical and Clerical Workers in Manufacturing Industries in Great Britain

(Page 3)

Year (October)	Administrative, Technical and Clerical Staff as Percentage of Total Employees in Employment	Year (October)	Administrative, Technical and Clerical Staff as Percentage of Total Employees in Employment
1948	16.0	1957	20.2
1949	16.4	1958	21.2
1950	16.5	1959	21.1
1951	17.0	1960	21.3
1952	18.1	1961	22.1
1953	18.2	1962	22.6
1954	18.4	1963	22.8
1955	19.0	1964	23.1
1956	19.8	—	—

Source—Ministry of Labour Gazette.

Administrative, Technical and Clerical Workers include:—

Managers, Superintendents and Works' Foremen; Research, Experimental, Development, Technical and Design Employees (other than operatives); Draughtsmen and Tracers; and Office (including Works' Office) employees.

**Industrial distribution of all A.D.P. installations and computers  
installed or on order at 1st January, 1964 for office work**

(Page 10)

**APPENDIX 3**

*Great Britain*

<i>GROUP OF INDUSTRIES</i>	<i>Number of Installations</i>				<i>Number of Computers</i>
	<i>Large</i>	<i>Medium</i>	<i>Small</i>	<i>Total</i>	
Agriculture, Forestry, Fishing, Mining and Quarrying ... ..	—	7	1	8	16
Food, Drink and Tobacco ... ..	1	21	9	31	37
Chemicals and Allied Industries ... ..	3	29	14	46	58
Metal Manufacture ... ..	—	19	6	25	35
Engineering and Electrical Goods ... ..	—	48	27	75	85
Shipbuilding and Marine Engineering ... ..	—	2	—	2	2
Vehicles ... ..	2	20	8	30	41
Metal goods not elsewhere specified ... ..	—	8	4	12	12
Textiles ... ..	—	9	5	14	16
Leather, Leather Goods and Fur ... ..	—	—	—	—	—
Clothing and Footwear ... ..	—	7	5	12	16
Bricks, Pottery, Glass, Cement, etc. ... ..	—	5	1	6	6
Timber, Furniture, Printing, etc. ... ..	—	8	3	11	11
Other Manufacturing Industries ... ..	—	7	3	10	11
Construction ... ..	—	4	—	4	4
Gas, Electricity and Water ... ..	1	19	11	31	38
Transport and Communication ... ..	3	13	7	23	29
Distributive Trades ... ..	2	22	13	37	41
Insurance, Banking and Finance ... ..	4	63	27	94	129
Professional and Scientific Services ... ..	—	3	4	7	8
Miscellaneous Services ... ..	—	11	9	20	22
Public Administration and Defence ... ..	8	36	20	64	86
<b>TOTALS ...</b>	<b>24</b>	<b>361</b>	<b>177</b>	<b>562</b>	<b>709</b>

**Geographical distribution of all A.D.P. Installations and Computers  
installed or on order at 1st January, 1964**

(Page 10)

**APPENDIX 4**

*Great Britain*

<i>Area, based on Ministry of Labour regions</i>	<i>Number of Installations</i>				<i>Number of Computers</i>
	<i>Large</i>	<i>Medium</i>	<i>Small</i>	<i>Total</i>	
London Postal District ... ..	5	114	51	170	214
South Eastern (excluding London Postal District) ... ..	3	31	17	51	72
Eastern and Southern ... ..	4	30	18	52	67
South Western ... ..	3	18	7	28	34
Midlands ... ..	5	56	26	87	110
Yorkshire and Lincolnshire ... ..	—	21	12	33	43
North Western ... ..	2	41	22	65	73
Northern ... ..	1	16	11	28	30
Scotland ... ..	1	22	11	34	39
Wales ... ..	—	12	2	14	21
<b>TOTALS ...</b>	<b>24</b>	<b>361</b>	<b>177</b>	<b>562</b>	<b>709</b>

**Prime reasons expressed for installing A.D.P.**  
**(including installations where only one reason was stated)**

*(Page 11)*

Replacement of worn out equipment	...	...	...	...	...	...	...	...	26 installations
Better service to management	...	...	...	...	...	...	...	...	25    "
Savings in data processing cost	...	...	...	...	...	...	...	...	23    "
Savings in manpower	...	...	...	...	...	...	...	...	9    "
Savings in office space	...	...	...	...	...	...	...	...	6    "
Quicker processing	...	...	...	...	...	...	...	...	5    "
Better service to customers	...	...	...	...	...	...	...	...	3    "
Better quality results	...	...	...	...	...	...	...	...	—    "
Others	...	...	...	...	...	...	...	...	7    "
<b>TOTAL</b>									<b>104    "</b>

**All reasons expressed for installing A.D.P.**

*(Page 12)*

Quicker processing	...	...	...	...	...	...	...	...	144 installations
Savings in data processing cost	...	...	...	...	...	...	...	...	137    "
Better service to management	...	...	...	...	...	...	...	...	115    "
Better quality results	...	...	...	...	...	...	...	...	110    "
Replacement of worn out equipment	...	...	...	...	...	...	...	...	66    "
Savings in office space	...	...	...	...	...	...	...	...	62    "
Savings in manpower	...	...	...	...	...	...	...	...	40    "
Better service to customers	...	...	...	...	...	...	...	...	29    "
Others	...	...	...	...	...	...	...	...	42    "

*Number of installations contributing to above figures — 344.*

*Most installations expressed more than one reason.*

## Types of work being undertaken by A.D.P.

(Page 14)

Type of work	Number of Applications
Payroll	227
Management accounting and statistics	208
Stock control	157
Financial accounting	157
Invoicing and billing	140
General statistics	107
Production control	75
Miscellaneous	46

Number of installations contributing to above figures—358.

## APPENDIX 8

## Methods superseded by A.D.P.

(Page 15)

Method or combination of methods	Number of A.D.P. installations affected
Clerical and punched cards and keyboard accounting machines	148
Clerical and punched cards	57
Clerical and keyboard accounting machines	51
Punched cards only	24
Punched cards and keyboard accounting machines	20
Clerical only	14
Keyboard accounting machines only	10
New work only (no supersession at all)	4
Total number of installations reporting	328

In addition there were 43 other methods and 25 instances of new work in combination with items classified above.

Average time taken to set up an A.D.P. system  
(Page 15)

APPENDIX 9

<i>Period</i>	<i>No. of Months</i>
Start of project to ordering of equipment...	15
Ordering of equipment to its delivery	19
Delivery of equipment to start of parallel running	2
Start of parallel running to live operation	2
Live operation to full take up	12
Full take up to complete change-over	9
<b>TOTAL</b>	<b>59</b>

*Number of installations contributing to above figures—251.*

Working population in four fields  
(Page 17)

APPENDIX 10

	<i>Males</i>	<i>Females</i>	<i>Total</i>
Total working population	16,628,000	8,634,000	25,262,000
Total employed in organisations with A.D.P. installed or on order	2,632,000	1,045,000	3,677,000
Total number of office workers in above A.D.P. organisations	470,000	424,000	894,000
Total number of office workers in A.D.P. areas of above organisations	100,000	106,000	206,000

*Total working population figures relate to mid-December 1963 (Source: Ministry of Labour Gazette).  
Other figures are estimates for 1st January, 1964, derived from replies to the computer enquiry.*



<i>Method</i>	<i>Number of installations who reported using method</i>
Normal losses by marriage, retirement, etc. ....	229
Transferred elsewhere (including unspecified transfers) ....	146
Reduction in recruitment... ....	116
Transferred to work in area of A.D.P. application ....	79
Temporary engagements ....	74
Absorbed by increases in work not due to A.D.P. ....	72
Redundant staff retained ....	43
Redundant staff discharged ....	32
Absorbed by increases in work due to A.D.P....	24
Existing staff shortages ....	20
Early retirements ....	15
Abnormal resignations ....	13

Total number of installations contributing to above figures—273

6

## Main sources of training for three A.D.P. occupations

(Pages 29 and 30)

Source of training	Number of installations reporting use of these sources for:—		
	Systems Analysts	Programmers	Machine operators
Machine Manufacturers only ... ..	101	176	58
Computer User only ... ..	28	24	111
Machine Manufacturer and Computer User ... ..	38	59	32

*In addition, some training was carried out by technical colleges and, in the case of government departments, systems analysts and programmers generally attended H.M. Treasury training school before proceeding to a course with a machine manufacturer.*

## APPENDIX 13

## Computer usage at 259 installations

(Page 33)

Weekly hours of computer operation	Number of installations
More than 120 hours ... .. <sup>a</sup>	12
81-120 hours ... ..	28
61-80 hours ... ..	51
More than normal office hours but not more than 60 hours ... ..	81
Normal office hours only ... ..	87
<b>TOTAL</b> ...	<b>259</b>

## Analysis of computer usage at 259 installations according to size of installation and size of user

(Page 23)

Size of user (Total No. of all employees)	Computer usage (as defined below)	Size of installation		
		Large	Medium	Small
10,000+ employees	A	4	2	
	B	4	7	1
	C	8	14	2
	D	3	17	2
	E	1	19	5
5,000— 10,000 employees	A		4	
	B		4	
	C	1	4	
	D	1	9	
	E		9	3
3,000— 5,000 employees	A			
	B		3	
	C	2	10	
	D		12	4
	E		6	11
1,000— 3,000 employees	A			
	B		3	2
	C		2	1
	D		11	4
	E		11	11
less than 1,000 employees	A		2	
	B		4	
	C		3	4
	D		14	4
	E		5	6
TOTALS		24	175	60

Computer usage: A=More than 120 hours per week.

B=81-120 hours per week.

C=61-80 hours per week.

D=More than normal office hours but not more than 60 hours per week.

E=Normal office hours only.

## Arrangement of hours worked by A.D.P. staff

(Page 34)

<i>Occupation</i>	<i>Numbers of installations who reported employing A.D.P. staff on basis of:</i>			
	<i>More than two shifts</i>	<i>Two-shift working</i>	<i>Normal office hours plus overtime</i>	<i>Normal office hours only</i>
Computer operators	28	61	60	79
Operators of other A.D.P. machines	11	16	39	118
Systems analysts	3	7	51	119
Programmers	7	11	72	98

*A number of organizations made no comment on these items, mostly because their computer projects were in an early stage and plans of staff hours had not yet been completed.*

Numbers of computers delivered for office work in Great Britain up to 1st January, 1965

(Page 42)

<i>Year</i>	<i>Number delivered during year</i>	<i>Cumulative total at end of year</i>
Prior to 1959	26	26
1959	10	36
1960	34	70
1961	55	125
1962	103	228
1963	162	390
1964	215	605

*This table excludes computers withdrawn from service prior to 1st January, 1964.*

Estimates of minimum future deliveries for new installations leading to 6,000 computers delivered by January, 1974

<i>Year</i>	<i>Number delivered during year</i>	<i>Cumulative total at end of year</i>
1965	265	870
1966	330	1,200
1967	400	1,600
1968	480	2,080
1969	570	2,650
1970	670	3,320
1971	780	4,100
1972	900	5,000
1973	1,000	6,000

*These estimates do not include computers to be delivered in replacement of others withdrawn from service, e.g. because of obsolescence.*

(Page 6)

GROUPS OF INDUSTRIES	Number of A.D.P. installations covered by:—			Total number of A.D.P. installations in G.B.
	Long reports (see Appendix 18)	Short reports (see Appendix 19)	All reports	
Agriculture, Forestry, Fishing, Mining and Quarrying	8	—	8	8
Food, Drink and Tobacco ... ..	18	4	22	31
Chemicals and Allied Industries ... ..	30	5	35	46
Metal Manufacture ... ..	18	1	19	25
Engineering and Electrical Goods ... ..	21	21	42	75
Shipbuilding and Marine Engineering, Vehicles ...	24	6	30	32
Metal Goods not elsewhere specified ... ..	4	3	7	12
Textiles ... ..	7	2	9	14
Leather, Leather Goods and Fur ... ..	—	—	—	—
Clothing and Footwear ... ..	3	3	6	12
Bricks, Pottery, Glass, Cement, etc. ... ..	4	—	4	6
Timber, Furniture, etc. ... ..	—	—	—	1
Paper, Printing and Publishing ... ..	5	—	5	10
Other Manufacturing Industries ... ..	1	1	2	10
Construction ... ..	3	—	3	4
Gas, Electricity and Water ... ..	25	3	28	31
Transport and Communication ... ..	17	—	17	23
Distributive Trades ... ..	16	3	19	37
Insurance, Banking and Finance ... ..	67	5	72	94
Professional and Scientific Services ... ..	5	1	6	7
Miscellaneous Services ... ..	8	1	9	20
Public Administration ... ..	58	2	60	64
TOTALS ...	342	61	403	562

SIZES OF A.D.P. INSTALLATIONS	Number of A.D.P. installations covered by:—			Total number of A.D.P. installations in G.B.
	Long reports	Short reports	All reports	
Large A.D.P. installations ... ..	24	—	24	24
Medium A.D.P. installations ... ..	234	39	273	361
Small A.D.P. installations ... ..	84	22	106	177
TOTALS ...	342	61	403	562

*Copy of main enquiry form*

Dear Sir,

As you may already know, the Ministry has set up a Manpower Research Unit to study future manpower requirements in the light of technological and other changes. The Unit, which is working in close co-operation with the National Economic Development Office, is looking at the future distribution of manpower between different industries and occupations and is carrying out a number of detailed enquiries in particular sectors. As recently announced by the Minister in Parliament, one of these concerns the effect of computers (i.e. automatic data processing or A.D.P.) on office employment. In view of the importance of this subject, and the current interest in it, we are anxious to carry out a realistic appraisal based on facts and informed opinion and it is for this reason that I am seeking your help.

The objects of our enquiry are:

- (1) to see what happens to staff whose work is transferred to automatic data processing;
- (2) to examine the longer term effect of A.D.P. on office employment as a whole, in numbers, organisation and quality of staff;
- (3) eventually to associate the effects of A.D.P. with other factors which influence manpower changes in order to assess overall trends in office employment.

We are inviting all organisations known to have ordered or installed digital computers for office work to complete copies of the attached form of report for their A.D.P. applications, including any for which equipment has not yet been ordered but which are sufficiently advanced to permit a report. Although participation is entirely voluntary, I hope you will feel able to co-operate in the enquiry, to which the Ministry attaches considerable importance.

A report for each particular application of A.D.P. (e.g. preparation of a payroll, stock control in a depot) is preferred, but you may find it more convenient to group information in another way—for example, by completing a report form for each separate machine installation. Naturally replies to the enquiry should be as precise as possible, giving figures wherever you can, but if exact information—such as numbers of employees in a particular grade—is not available, it would be useful if you would bear in mind the objectives of this enquiry and provide estimates aimed at presenting the best possible picture. This, of course, will also apply where an A.D.P. system is still in course of development and the answers to some questions will be forecasts.

In order to suit many types of applications in various stages of progress the questionnaire has had to be drawn in broad terms, and we are placing much reliance on your recognition of our objectives and on your assistance in giving us the detailed information you will appreciate we need.

Finally, as the planning and installation of A.D.P. systems take a long time and their full effects emerge over a considerable period, it would be helpful if you would also let me have any views based on your experience so far or on plans already under consideration on any longer term developments in your A.D.P. activities. This further appraisal would include, for example, the sort of further advantages you expect to realise, whether you expect A.D.P. to contribute to or lessen the current trend towards a rising proportion of office workers in employment, the final effect on office employment and any foreseeable difficulties which may delay progress more than you consider necessary.

May I repeat that your help in this enquiry will be very much appreciated. All the information will be treated in confidence and I shall be glad to arrange for an officer of the Unit to visit you to discuss the enquiry at any stage should this seem helpful.

We hope to receive completed questionnaires during the month of January, but perhaps you could let me know as soon as possible whether or not you feel able to co-operate.

Yours faithfully,

## MINISTRY OF LABOUR

Enquiry into the Effect of Automatic Data Processing  
on Office Employment

## NOTES

1. If at any point the form of report does not fit your circumstances, (for example, where the work being done on A.D.P. has never been done by other methods; or you are reporting on an A.D.P. system which has itself been superseded, possibly by another A.D.P. system; or the effects of A.D.P. have been swamped by changes from other causes), it would nevertheless be valuable if you would complete as much of the report form as is applicable and, bearing in mind the objectives of the enquiry, give a narrative report of your experience in as much detail as you can.
2. The effect of bureau work, i.e. where substantial amounts of processing are done for other organisations, will be the subject of separate enquiry. If you provide such a service and also do work for your own organisation, will you please base your report only on the latter, except for such items as number 12 where we should appreciate a brief outline of the bureau work.
3. Where the A.D.P. system has not yet reached completion, please state the final expectations in preference to the interim position. Please also ensure that all forecasts are identified as such, either by the context or by endorsing them "F".
4. Part-time staff should be included in any figures as full units, but, if significant, their numbers and hours of employment should also be given separately. Part-time activity in any specific job, such as programming, should be treated similarly.

## DEFINITIONS FOR THE PURPOSE OF THIS ENQUIRY

**Automatic data processing, or A.D.P.:** this enquiry is concerned only with automatic processing of office work involving an electronic computer, and all references in this enquiry to automatic data processing or A.D.P. should be construed with this meaning.

**Office employment** in this enquiry means broadly the work of administering private or public business. It includes processing of statistics, stock control, payroll preparation, production control, critical path analysis, invoicing, billing, accounting, maintenance of records, costing and other work of a similar nature. It does not include design calculations, research and scientific work.

**Office workers** are defined for this enquiry as being employed on the work described above as "office employment", being mainly engaged on classifying, computing, recording, evaluating and storing data, together with such associated duties as typing and messengerial services and the functions of management. Designers, draughtsmen and scientists are not included. Some workers may be only partly on office work, e.g. salesmen (see also note 4 above).

**Computers relevant to this enquiry** do not include calculators of the type which have a small store and a programme set up on a plugboard or similar device.

**Area affected by A.D.P.** should include all staff with work materially affected by A.D.P. The boundary can usually be drawn to provide a reasonable unit for study; this may of course include staff with work unchanged by A.D.P.

**Start of project** occurs when the first serious examination is made into the possibilities of using an A.D.P. system.

**Ordering of equipment** occurs when a formal order is placed and work proceeds on detailed planning and programming.

**Start of parallel running** occurs with the first operation of the A.D.P. system on authentic data, undertaken while the previous system is still operating to prove the accuracy of the A.D.P. system, usually by some comparison of results.

**Start of live operation** occurs where the A.D.P. system alone first undertakes real processing.

**Full take-up by A.D.P.** occurs when the A.D.P. system which may have been parallel-run and transferred to live operation piecemeal, is wholly on live operation.

**Completion of changeover** occurs with the final establishment of the A.D.P. system and the full resolution of all that was superseded, including the clearance of any staff redundancies and re-organisation.



## MINISTRY OF LABOUR

Enquiry into the Effect of Automatic Data Processing  
on Office Employment

Name and address of the Organisation:

Business:

Short designation of the A.D.P. system covered by this report

If any other return has a significant bearing upon this one, please cross reference it here, indicating briefly its relationship:

Name, address, telephone number and position of member of Organisation's staff whom we should contact if any further enquiry is needed about this report:

Please describe here more fully the coverage of this report (e.g. whether it is based on the work of one machine installation or on one particular type of application, such as stock control, or a number of installations engaged on similar or interdependent work) and add some detail of the nature and purposes of the processing:

## OFFICE MACHINES

1. A.D.P. equipment installed, planned or envisaged (including type of computer, size of computer store, number of magnetic tape units and other significant peripheral equipment) and their location:

2. Methods superseded or expected to be superseded by A.D.P. (e.g. punched cards, keyboard accounting machines, clerical):

3. Any other mechanisation, either current or proposed, which might be of significance in appreciating the background to your A.D.P. development:

## 4. TIME TABLE for transition to A.D.P. system:

*Dates actual or anticipated*

Start of project\*

Ordering of equipment\*

Delivery of computer

Start of parallel running\*

Start of live operation\*

Full take-up by A.D.P.\*

Completion of changeover\*

\* See definitions attached.

## NUMBERS OF EMPLOYEES

5.

	At start of project		On completion of changeover		On 1st January, 1964	
	↑		↑			
	Males	Females	Males	Females	Males	Females
Total number of all employees						
No. of office workers*						
No. of office workers in area affected by A.D.P.*						

## Analysis of office workers in area affected by A.D.P.

Management and Executive staff

Supervisory staff

Clerical staff

Typists (shorthand and copy)

Office machine operators on:  
data preparation for A.D.P.

all other A.D.P. equipment

desk calcs. and a/cg. mos.

other office machines

Systems analysts and planners

Programmers

Other staff (please specify):

Total (as in third main item)

6. Any additional points which you consider necessary to clarify or supplement the above figures (such as any appreciable numbers of staff engaged or expected to be engaged temporarily to cover a transitory phase in the project and who may or may not be included in above figures: staff surpluses, or shortages; effect of general expansion in business; work outside the office area materially affected by A.D.P.).

\* See definitions attached.

† Please enter dates as in item 4.

**COMPOSITION OF OFFICE STAFFS**

7. Extent to which A.D.P. has changed or is expected to change the composition of the office staff: by altering the relative cadres of management/supervisory/clerical and machine operating personnel, their relationships and promotion prospects; by causing certain occupations to decline or increase in numbers, skill or importance, etc. Please give figures where possible, particularly to show numbers and types of office posts abolished and created.

**LOCATION OF PROCESSING**

8. The extent to which various jobs connected with A.D.P. are or will be done in one place (e.g. planning work for processing, data preparation, computer processing, action on results), mentioning any aspects of particular interest, such as data preparation at source and data transmission systems.

9. Any changes in the location of the above-mentioned jobs consequent on setting up the A.D.P. systems, including the extent of the move and the reasons for it.

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(Note: the redeployment of any staff affected by removal of their work to another place is the subject of item 15 on page 6.)

**ORGANISATION OF WORK**

10. The number of hours a week you use or expect to use your A.D.P. machines, particularly the extent of machine usage outside normal office hours. If processing includes more than one type of job, please give separate figures for each (i.e. for statistics, payroll, stores, production control, work outside the scope of this enquiry, etc.)

11. The extent of help in the A.D.P. application from outside your own organisation, particularly the amount of manpower and sources of supply (e.g. from consultants, service bureaux, computer manufacturers, other installations, including overseas; for planning, data preparation, computer processing, machine maintenance, programming, autocodes and other software).

12. The extent to which you help others; along the lines of item 11.

13. Whether (a) systems analysis, (b) programming and (c) computer operating is the responsibility of one central team or of separate users of the installation.

**REDEPLOYMENT OF STAFF**

14. What has happened to the staff who used to do the work now done by A.D.P.? Please give as much detail as possible using forecasts where necessary, and covering such points as:

Normal staff losses by marriage, retirement, etc.:

Early retirement:

Transfers to other work in the area of the A.D.P. application or elsewhere:

Absorption by increases in overall workload in area of A.D.P. application or elsewhere:

Retention of redundant staff as supernumary:

Discharge of redundant staff:

Whether the installation of A.D.P. affected the volume of work for processing:

Whether staff transfers involved a change of status:

Severance payments and help in finding other jobs.

15. What happened in particular to any of the above-mentioned staff who were affected by removal of their work to another place?

Please reply on lines of the preceding item, identifying also those who were transferred to the new processing centre, those who were offered such transfer but refused, those who were given different work at the original place, the extent of any reimbursement or incentive to move to work elsewhere, etc.

16. What staff were brought from outside the area affected by A.D.P. to fill posts in the A.D.P. area, including new engagements?

17. What effect did any of the following have on the redeployment of each category of personnel: sex, marital state, age, seniority, physical fitness?

18. To what extent was retraining of staff used in redeploying personnel?

19. How far did you find it advisable and practicable to organise redeployment of staff in advance for the various stages of the application? Did you reduce recruitment of staff in anticipation of redundancy? How were employees informed about forthcoming changes? Were consultations with trade unions or staff associations involved and at what stages?

**CONDITIONS OF EMPLOYMENT**

20. Hours worked by A.D.P. staff, particularly outside normal office hours, any shift arrangements, week-end working or rota system, with numbers, grades and sex of staff concerned, etc.
21. Any experience or views you may hold on additional pay for inconvenient hours of work, incentive and bonus payments, etc, in the field of A.D.P.
22. Extent to which staff may become A.D.P. specialists, how far they will remain eligible for transfer or promotion to other jobs in the employer's organisation and their career prospects.
23. Any significant difficulties or special arrangements, not already mentioned, arising from changed working conditions (e.g. from abnormal hours of employment, noise and heat from machines, discipline of A.D.P. procedures, monotony, fatigue, etc.)

**RECRUITMENT OF A.D.P. STAFF**

24. Sources and methods of recruitment of each type of A.D.P. staff (e.g. data processing managers, systems analysts, programmers, machine operators: from staff whose jobs were affected by A.D.P., from elsewhere in the organisation, from outside sources, etc.)
25. Effect of A.D.P. on the educational qualifications, age limits, medical standards, aptitudes and other requirements you set for staff, showing, where appropriate, the requirements of separate A.D.P. occupations.
26. Extent and source of training for each grade of A.D.P. staff, including those recruited during the transition to A.D.P., those entering under the long-term arrangements for the installation and staff transferred from other parts of your own organisation (other than personnel displaced by A.D.P., who are covered by item 18 above).
27. Any difficulties met in obtaining suitable staff for A.D.P.

**EVALUATION OF A.D.P.**

28. Please state the reasons for initiating the A.D.P. system and say, where possible, how these expectations have been fulfilled in practice. Points which may be relevant include changes in cost, speed, quality and volume of work processed, manpower, commercial prestige, office space. To help isolate the effects of A.D.P. from other factors, it might be especially useful in this item and the rest if you would endeavour to compare the situation in which A.D.P. is used with what it would have been without A.D.P.
29. In particular please indicate the numbers and types of office posts you expected to save by A.D.P. and, so far as possible, an estimate of the actual savings.

## Copy of short enquiry form.

Firms who were unable to provide a report on the full questionnaire shown in Appendix 18 were invited to complete a short report in the form below.

## MINISTRY OF LABOUR

## Enquiry into the Effect of Automatic Data Processing on Office Employment

Name and address of the Organisation:

Business:

A.D.P. equipment on order or installed:

Date of delivery:

Its location:

The purpose of the equipment (e.g. payroll, production control, invoicing)

Your present complement of A.D.P. staff:

Males	Females

Data processing manager ... ..

Systems analysts and planners ... ..

Programmers ... ..

Machine operators: data preparation ... ..

Other machine operators on A.D.P. ... ..

Other A.D.P. staff (please specify) ... ..

Total

Please state why you decided to obtain A.D.P. equipment:

If possible please give an estimate of the number and types of office jobs you have abolished or expect to abolish by A.D.P. (comparing the staffing requirements of the A.D.P. system with what would be needed without it).



